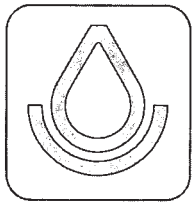
SOIL SURVEY OF
Pottawatomie County, Oklahoma



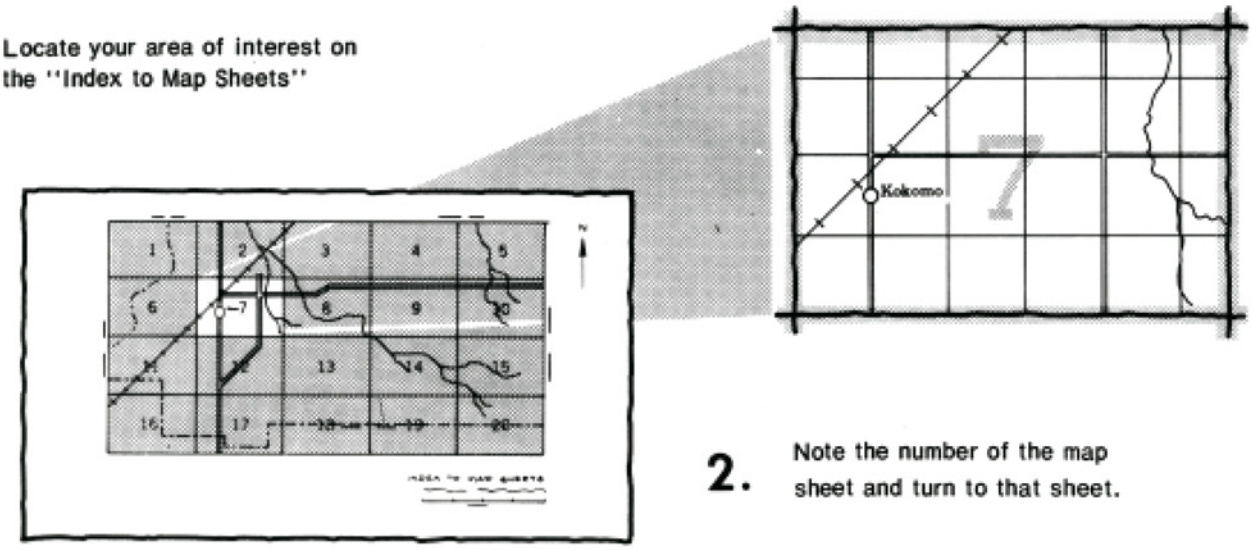
United States Department of Agriculture
Soil Conservation Service

In cooperation with

Oklahoma Agricultural Experiment Station

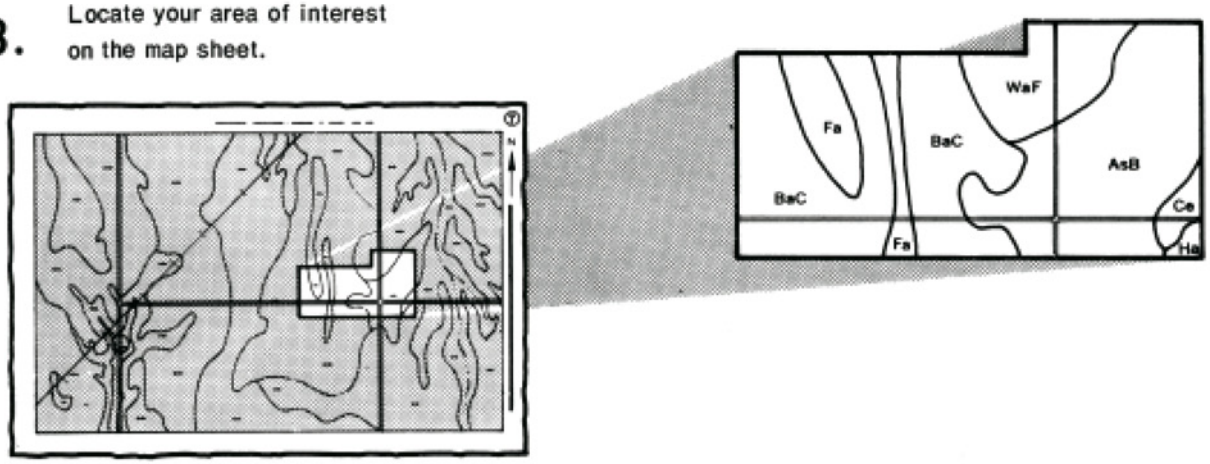
HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets"

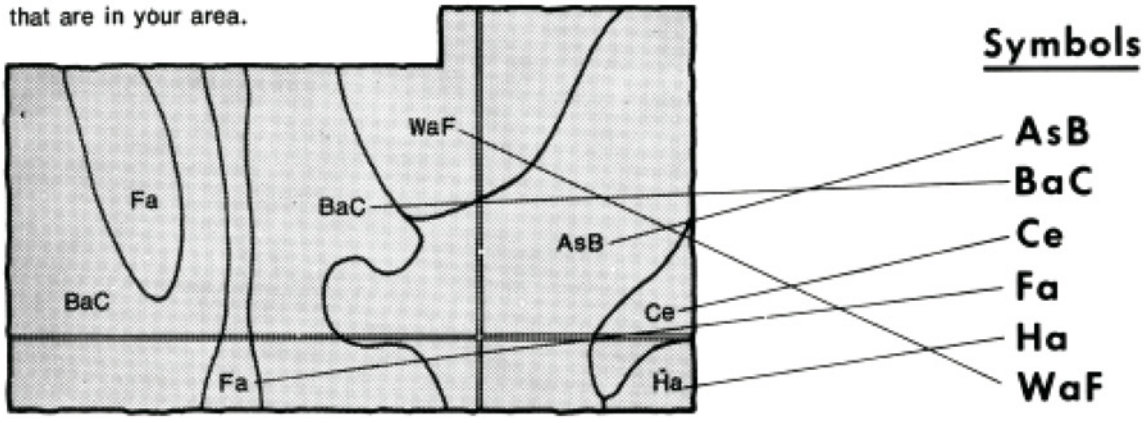


2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.

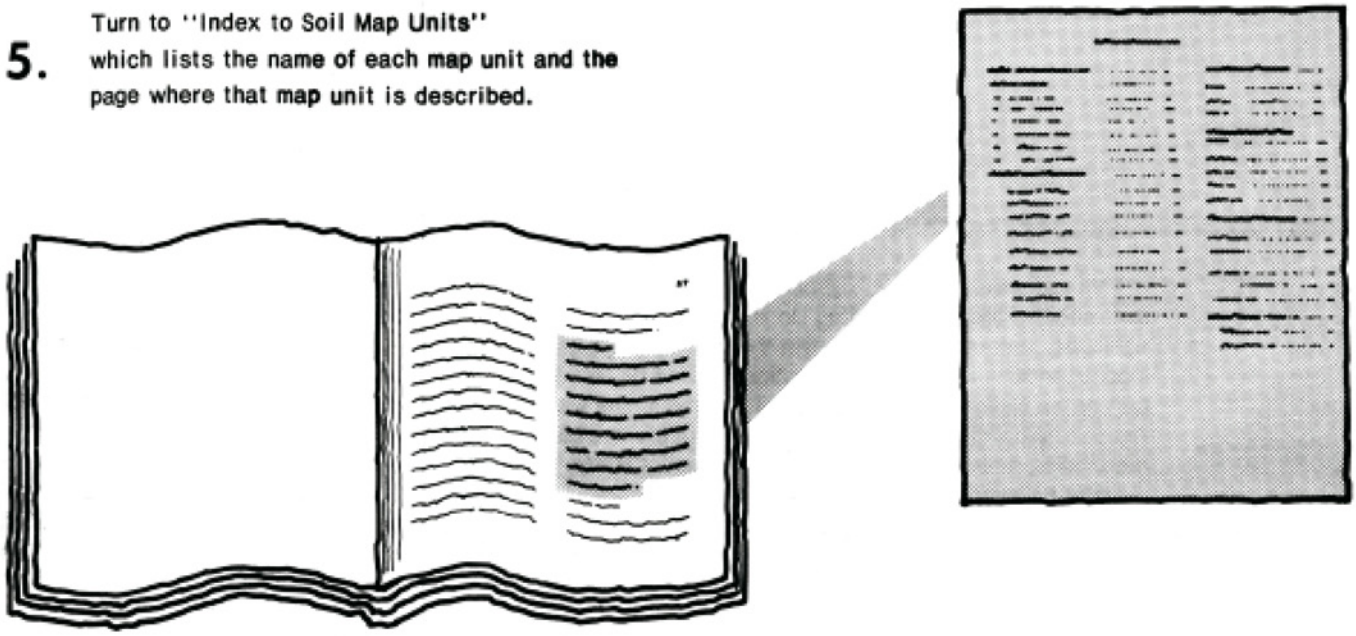


4. List the map unit symbols that are in your area.

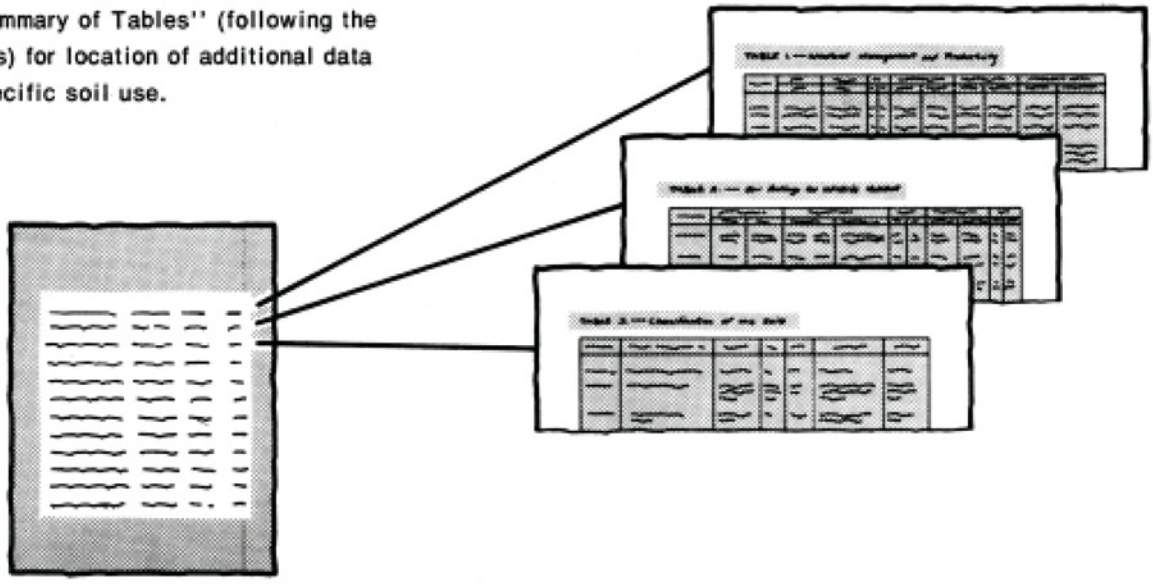


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all who need the information, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1962-72. Soil names and descriptions were approved in 1974. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1974. This survey was made cooperatively by the Soil Conservation Service and the Oklahoma Agricultural Experiment Station. It is part of the technical assistance furnished to the Shawnee and Konawa Conservation Districts.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

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Issued August 1977

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Foreword

I would like to introduce the Soil Survey of Pottawatomie County, Oklahoma. You will find herein much basic information useful for any land planning program. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land use will have on the environment.

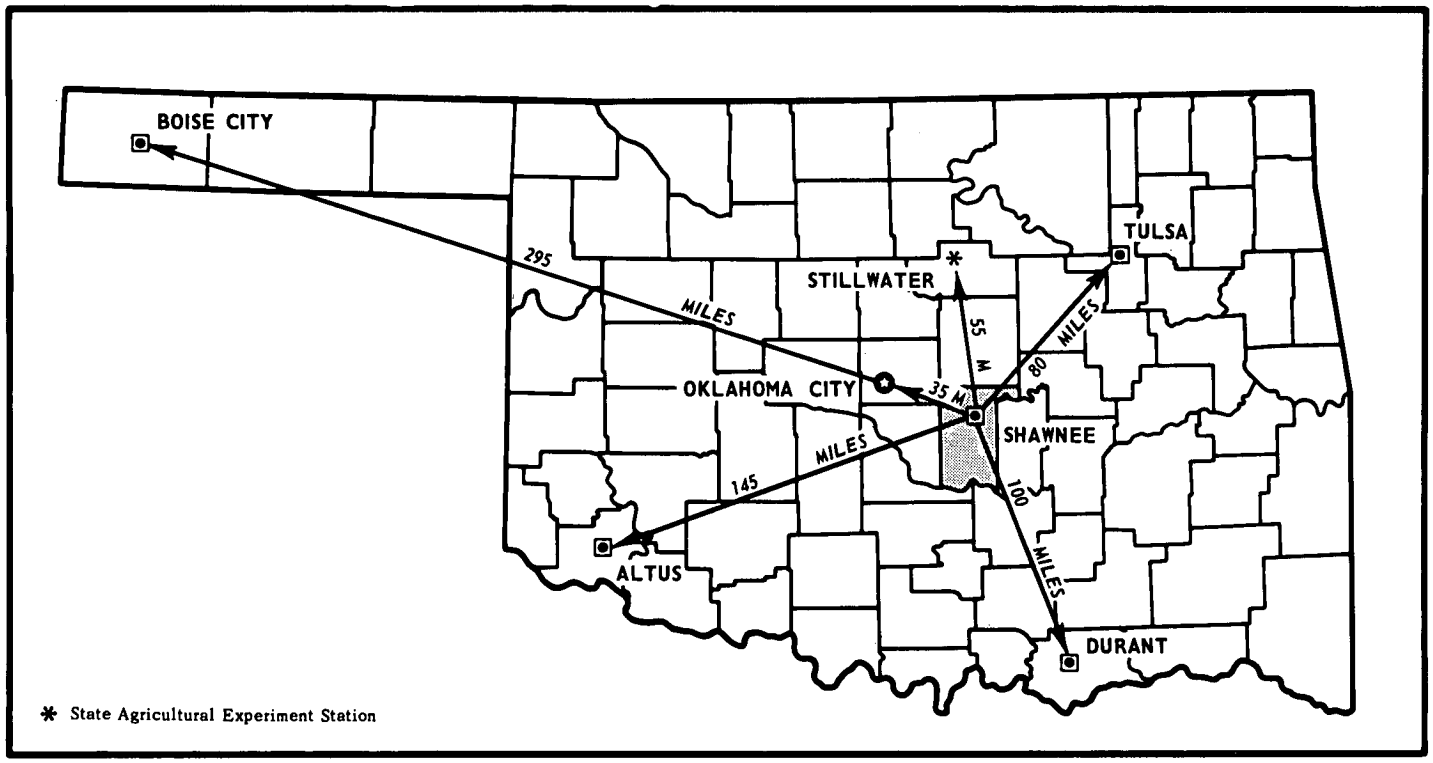
This soil survey has been prepared for many different users. Farmers, ranchers, foresters, or agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community decisionmakers, engineers, developers, builders, or homebuyers can use it to plan use of land, select sites for construction, develop soil resources, and identify any special practices that may be needed to assure proper performance. Conservationists, recreationists, teachers, students, or specialists in wildlife management, waste disposal, or pollution control can use the soil survey to help understand, protect, and enhance the environment.

Many people assume that soils are all more or less alike. They are unaware that great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. This publication also shows, on the general soil map, the location of broad areas of soils; the location of each kind of soil is shown on detailed soil maps at the back. It provides descriptions of each kind of soil in the survey area and gives much information about each soil for specific uses. If you need additional information or assistance in using this publication, please call your local office of the Soil Conservation Service or the Cooperative Extension Service.

I believe that this soil survey will help you to have a better environment and a better life. The widespread use of this information will greatly assist all of us in the conservation, development, and productive use of our soil, water, and related resources.

State Conservationist
Soil Conservation Service



Location of Pottawatomie County in Oklahoma.

SOIL SURVEY OF POTTAWATOMIE COUNTY, OKLAHOMA

BY RICHARD E. MAYHUGH, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE OKLAHOMA AGRICULTURAL EXPERIMENT STATION

POTTAWATOMIE COUNTY is in the central part of Oklahoma (see facing page). The county is bounded on the west by Cleveland and Oklahoma counties, on the north by Lincoln County, on the east by Okfuskee and Seminole Counties, and on the south by Pontotoc and McClain Counties. Shawnee, the county seat, is in the north-central part of the county. The county has an area of 513,920 acres, or 803 square miles.

General Nature of the County

Pottawatomie County was formerly part of Indian territory. Early settlers, other than Indian tribes, migrated into the county in the latter part of the 19th century and established small subsistence farms. Cotton, small grains, and alfalfa hay were the major cash crops, and only enough other crops were grown to provide feed for hogs, chickens, dairy and beef cattle, and work stock.

Raising beef cattle is now the major enterprise in Pottawatomie County. Small grains, alfalfa, grain sorghum, peanuts, and soybeans are commonly grown. The northern part of the county is becoming more urban, and farms are being divided into small tracts.

The major industry in Pottawatomie County is oil and gas production. There are a few small manufacturing companies in the vicinity of Shawnee. A few areas are quarried for commercial sand and gravel. Many county residents work in the vicinity of Oklahoma City.

Pottawatomie County has a well distributed system of highways, including Interstate 40, U.S. Highways 177 and 9, and several state highways. A fairly good network of all-weather roads is maintained by the county.

The temperate, continental climate is marked by rapid changes in weather. Spring has the most changeable conditions and provides the greatest number of severe local storms and the heaviest rains. Long, hot summers are eased by occasional rains and moderate winds. The cooler weather in the fall is accompanied by adequate rain in September followed by an increasing number of sunny days. Winters are generally short and mild and have only brief periods of low temperature and snow cover.

Timbered and prairie soils are of about equal extent in the county. The native vegetation in timbered areas is mostly oaks, hickory, and redcedar with an understory of grasses. The native vegetation in prairie areas is big bluestem, little bluestem, indiangrass, switchgrass, and forbs.

The major streams of the county enter from the west and generally flow eastward to the Arkansas River. The elevation of the county averages about 1,000 feet. The county is characterized by sandstone ridges and shale valleys traversed by many narrow streams. Slopes range from nearly level to strongly sloping in most of the county.

Climate

This section was prepared by STANLEY G. HOLBROOK, climatologist for Oklahoma, National Weather Service, U.S. Department of Commerce.

The climate of Pottawatomie County is moist-subhumid. Seventy-five percent of the normal annual precipitation occurs during the crop season, much of it during thunderstorms which frequently produce high intensity rainfall. Thunderstorms occur on an average of 50 days of a normal 211-day crop season in Pottawatomie County. There are normally 35 days during the crop season with rainfall of 0.10 inch or more, 25 days with rainfall of 0.25 inch or more, 18 days with rainfall of 0.50 inch or more, 9 days with rainfall of 1 inch or more, and 2 or 3 days with rainfall of more than 2 inches. Since 1902, the greatest daily rainfall at Shawnee was 7.86 inches on June 3, 1932. It is estimated that a 24-hour rainfall of 6.35 inches will occur once every 10 years, a 24-hour rainfall of 7.40 inches will occur once every 25 years, a 1-hour rainfall of 2.95 inches will occur once every 10 years, and a 1-hour rainfall of 3.40 inches will occur once every 25 years. The estimated return period of a 15-minute rainfall of 1.68 inches is 10 years, and of a 15-minute rainfall of 1.95 inches, 25 years.

The normal seasonal snowfall in Pottawatomie County is approximately 8 inches. There are 3 days during a normal snowfall season with 1 inch or more of snow and 4 or 5 days with an inch or more of snow on the ground. Since 1910, the greatest seasonal snowfall at Shawnee has been 20.9 inches in 1959-60. Several seasons since 1910 have not seen enough snow to measure.

Temperatures of 90 degrees F or higher are frequent from June through September and have occurred from March through October. Temperatures of 100 degrees or higher occur on about 15 days in a normal year, mostly in July and August. The highest temperature of record at Shawnee was 116 degrees on August 10, 1936.

Temperatures are usually mild in winter (table 1) but there are occasional outbreaks of very cold air. Minimum temperatures of 32 degrees or less occur on nearly 80 days in a normal year, and on 5 of these days, the temperature remains at or below 32 degrees throughout the day. A temperature of zero or below has been observed at Shawnee on only 23 days in the past 30 years. The lowest temperature of record at Shawnee was -14 degrees on January 18, 1930, and on earlier dates.

The average date of the last spring freeze at Shawnee is April 3, and the average date of the first fall freeze is October 31. Freezing temperatures have occurred as late as May 1 and as early as October 7. For probabilities of last freezing temperatures in spring and first in fall see table 2.

The prevailing wind direction is southerly across Pottawatomie County although northerly winds are about as common from November through March. The average monthly windspeed is about 12 m.p.h. Strong, gusty winds occur with thunderstorms and with low pressure systems migrating from west to east during the winter and spring.

The average 6 a.m. relative humidity is 75 to 85 percent throughout the year. The average 6 p.m. relative humidity varies from about 45 percent in August to 65 percent in January. An average of 140 clear days, 100 partly cloudy days, and 125 cloudy days provide the County with about 65 percent of the year's total possible sunshine.

Pottawatomie County, like all of Oklahoma, is susceptible to severe storms, which occur more frequently during hot spring afternoons but which can occur and have occurred during every month of the year and at every hour of the day. Hail occurs on 4 days of a normal year, but not all hailstorms are so intense as to be damaging to crops and property.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Pottawatomie County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes; the size and speed of streams; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Gaddy and Konawa, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Konawa fine sandy loam, 0 to 3 percent slopes, is one of several phases within the Konawa series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Pottawatomie County: soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intricately mixed or so small that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the

name or names of the dominant soils, joined by a hyphen. Stephenville-Darnell complex, 5 to 12 percent slopes, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but that are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. If there are two or more dominant series represented in the group, the name of the group ordinarily consists of the names of the dominant soils, joined by "and." Chickasha and Zaneis soils, 1 to 8 percent slopes, severely eroded is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Gravel Pits is an example.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or to its high water table. They see that streets, road pavements, and foundations for houses are cracked on a particular soil and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Pottawatomie County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the locations of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field or for selecting the exact location of a road, building, or similar structure because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in Pottawatomie County are discussed in the following pages.

The terms for texture used in the title for several of the associations apply to the texture of the surface layer. For example, in the title of assocation 1, the words "loamy soils" refer to the texture of the surface layer.

Not all soil names on the Pottawatomie County general soil map are the same as those in adjacent Lincoln and Oklahoma Counties. Most of the differences in names result from refinements in the system of soil classification.

1. Port-Yahola-Keokuk Association

Deep, nearly level through very gently sloping, well drained, loamy soils on flood plains

This association makes up about 16 percent of the total land area of the county. About 26 percent is Port soils, about 13 percent is Yahola soils, and about 11 percent is Keokuk soils (fig. 1). The remaining 50 percent is soils of minor extent, mostly Asher, Fluvents, Gaddy, Gracemont, Gracemore, Harjo, Latanier, Lela, Miller, Pulaski, and Sayers soils, and water in lakes.

Port soils are deep, nearly level through very gently sloping, well drained, loamy soils with a loamy subsoil over loamy sediment.

Yahola soils are deep, nearly level through very gently sloping, well drained, loamy soils with a loamy subsoil over loamy sediment.

Keokuk soils are deep, nearly level, well drained, loamy soils with a loamy subsoil over loamy sediment.

Most of the soils in this association are used for bermudagrass, alfalfa hay, grain sorghum, wheat, peanuts, and soybeans. They are also suited to all crops adapted to the climate of the county.

The principal management concerns are maintaining soil structure and fertility and protecting the soils from damaging floods, although the Keokuk soils are rarely flooded. The soils in this association respond favorably to good management.

2. Weatherford-Chickasha Association

Deep, very gently sloping through sloping, well drained, loamy soils on uplands

This association makes up about 13 percent of the total land area of the county. About 39 percent is Weatherford soils, and 18 percent is Chickasha soils. The remaining 43 percent is soils of minor extent, mostly Aydelotte, Konawa, Port, Pulaski, Renfrow, Stephenville, Teller, Tribbey, Vernon, Windthorst, and other soils.

Weatherford soils are deep, very gently sloping through sloping, well drained, loamy soils with a loamy subsoil over sandstone.

Chickasha soils are deep, very gently sloping through sloping, well drained, loamy soils with a loamy subsoil over sandstone.

Most of the soils in this association are used for pasture and range. They are also suited to small grains, grain sorghum, peanuts, and soybeans.

The principal concerns of management on these soils are maintaining fertility and soil structure and keeping erosion within allowable limits. Using crop residue and plant food and building terraces on sloping land help maintain the soil and its productivity. Proper management of the pasture and range controls erosion and helps produce high forage yields.

3. Konawa-Eufaula Association

Deep, nearly level through strongly sloping, well drained or somewhat excessively drained, sandy or loamy soils on uplands

This association makes up about 12 percent of the total land area of the county. About 50 percent is Konawa soils, and 18 percent is Eufaula soils. The remaining 32 percent is soils of minor extent, mostly Dougherty, Galey, Norge, Port, Pulaski, Stephenville, Teller, Tribbey, Vanoss, Weatherford, Zaneis, and other soils.

Konawa soils are deep, nearly level through sloping, well drained, loamy and sandy soils with a loamy subsoil over loamy or sandy sediment.

Eufaula soils are deep, nearly level through strongly sloping, somewhat excessively drained, sandy soils with a sandy subsoil over sandy sediment.

Most of the soils in this association are used for pasture and range. Some are also suited for growing small grains, grain sorghums, peanuts, and soybeans.

The principal management concerns are maintaining soil structure and fertility and keeping erosion within allowable limits. These soils respond favorably to good management.

4. Aydelotte-Renfrow-Zaneis Association

Deep, very gently sloping through sloping, well drained, loamy soils on uplands

This association makes up about 15 percent of the total land area of the county. About 31 percent is Aydelotte soils, 15 percent is Renfrow soils, and 13 percent is Zaneis soils (fig. 2). The remaining 41 percent is soils of minor extent, mostly Carytown, Chickasha, Kirkland, Norge, Port, Stephenville, Teller, Vanoss, Vernon, Weatherford, Windthorst, and other soils.

Aydelotte soils are deep, very gently sloping through sloping, well drained, loamy soils with a clayey or loamy subsoil over shale or clay.

Renfrow soils are deep, very gently sloping through gently sloping, well drained, loamy soils with a clayey or loamy subsoil over shale or clayey sediment.

Zaneis soils are deep, very gently sloping through sloping, well drained, loamy soils with a loamy subsoil over sandstone or sandy shale.

Most of the soils in this association are used for pasture or range. These soils are also suited to small grains, grain sorghum, and soybeans.

The principal management concerns are maintaining soil structure and fertility and keeping erosion within allowable limits. The soils respond favorably to good management.

5. Stephenville-Darnell Association

Moderately deep or shallow, very gently sloping through strongly sloping, well drained or somewhat excessively drained, loamy soils on uplands

This association makes up about 29 percent of the total land area of the county. About 24 percent is Stephenville soils, and 8 percent is Darnell soils (fig. 3). The remaining 68 percent is soils of minor extent, mostly Aydelotte, Chickasha, Chigley, Dougherty, Eufaula, Konawa, Noble, Port, Pulaski, Renfrow, Teller, Tribbey, Vernon, Weatherford, Windthorst, Yahola, and other soils.

Stephenville soils are moderately deep, very gently sloping through strongly sloping, well drained, loamy soils with a loamy subsoil over sandstone.

Darnell soils are shallow, sloping through strongly sloping, well drained to somewhat excessively drained, loamy soils with a loamy subsoil over sandstone.

Most of the soils in this association are used for range and pasture. Some are suited to small grains, grain sorghum, peanuts, and soybeans.

The principal concerns in management of these soils for cultivated crops are maintaining soil structure and fertility and keeping erosion within allowable limits. Using crop residue and fertilizer and building terraces on sloping land help maintain the soil and its productivity. Proper management of the pasture and range controls erosion and helps produce fair forage yields.

6. Vernon Association

Deep, gently sloping through strongly sloping, well drained, clayey or loamy soils on uplands

This association makes up about 10 percent of the total land area of the county. About 67 percent is Vernon soils (fig. 4). The remaining 33 percent is soils of minor extent, mostly Aydelotte, Port, Pulaski, Renfrow, Stephenville, Teller, Weatherford, Yahola, Zaneis, and other soils.

Vernon soils are deep, gently sloping through strongly sloping, well drained, clayey or loamy soils with a clayey subsoil over shale or clayey sediment.

Most of the soils in this association are used for range. Some are suited to small grains, grain sorghums, peanuts, soybeans, and tame pasture grasses.

The principal management concern is keeping the grasses growing vigorously.

7. Seminole-Chickasha-Aydelotte Association

Deep, nearly level through sloping, moderately well drained or well drained, loamy soils on uplands

This association makes up about 5 percent of the total land area of the county. About 30 percent is Seminole soils, 14 percent is Chickasha soils, and 12 percent is Aydelotte soils (fig. 5). The remaining 44 percent is soils of minor extent, mostly Carytown, Norge, Port, Renfrow, Stephenville, Teller, Vanoss, Vernon, and Zaneis soils.

Seminole soils are deep, nearly level through gently sloping, moderately well drained, loamy soils with a clayey or loamy subsoil over clayey or loamy sediment on shale.

Chickasha soils are deep, very gently sloping through sloping, well drained, loamy soils with a loamy subsoil over sandstone.

Aydelotte soils are deep, very gently sloping through sloping, well drained, loamy soils with a clayey or loamy subsoil over clayey sediment or shale.

Most of the soils in this association are used for pasture or range. These soils are also suited to small grains, grain sorghum, peanuts, and soybeans.

The principal management concerns are maintaining soil structure and fertility and keeping erosion within allowable limits. The soil responds favorably to good management.

Descriptions of the Soils

In this section the soils of Pottawatomie County are described. Each soil series is described in detail, and then, briefly, the mapping units in that series are described. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. Color terms are for dry soil unless otherwise stated. The profile described in the soil series is representative for mapping units in that series. If a given mapping unit has a profile in some ways different from the one described in the series, these differences are stated in the description of the mapping unit or they are apparent in the name of the mapping unit. The description of each mapping unit contains suggestions on how the soil can be managed.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Fluvents, for example, do not belong to a soil series; nevertheless they are listed in alphabetic order along with the soil series.

Preceding the name of each mapping unit is the symbol that identifies the mapping unit on the detailed soil map. Listed at the end of the description of each mapping unit are the capability unit, range site, pasture and hayland suitability group, windbreaks tree suitability group, and woodland suitability group in which the mapping unit has been placed.

The approximate acreage and proportionate extent of each mapping unit are shown in table 3. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*3*).

Asher Series

The Asher series consists of deep, moderately well drained, nearly level soils on flood plains. These soils formed under a cover of hardwood forest and grass in material weathered from loamy sediment.

In a representative profile the surface layer is 10 inches of dark gray silty clay loam. The subsoil, to a depth of 21 inches, is reddish brown silty clay loam. It is underlain by brown silt loam to a depth of 65 inches.

Asher soils have slow permeability. Available water capacity is high.

Representative profile of Asher silty clay loam, about 1,200 feet north and 50 feet east of the southwest corner of section 3, T. 11 N., R. 2 E.:

Ap—0 to 10 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) when moist; weak fine granular structure; hard, firm; many pores; mildly alkaline; abrupt smooth boundary.

B2—10 to 21 inches; reddish brown (5YR 5/3) silty clay loam, reddish brown (5YR 4/3) when moist; weak fine blocky structure; very hard, firm; secondary carbonates at 14 inch depth and below; dark gray (10YR 4/1) coatings on faces of some peds; calcareous; moderately alkaline; clear smooth boundary.

IIC—21 to 65 inches; brown (10YR 5/3) silt loam, brown (10YR 4/3) when moist; massive; slightly hard, very friable; common thin strata of very fine sandy loam, fine sandy loam, and silty clay loam; calcareous; moderately alkaline.

The A1 or Ap horizon is dark gray, dark grayish brown, grayish brown, brown, dark reddish gray, or gray. It ranges from slightly acid

through moderately alkaline. The B2 horizon is reddish brown, brown, dark reddish gray, or reddish gray. It ranges from neutral through moderately alkaline. The IIC horizon is brown, grayish brown, pale brown, very pale brown, light yellowish brown, reddish brown, or reddish gray. It ranges from mildly alkaline through moderately alkaline. It is silt loam, very fine sandy loam, or loam.

1—Asher silty clay loam. This is a nearly level soil. It has the profile described as representative for the series. It is subject to rare flooding.

Included with this soil in mapping are soils that are similar to Asher silt loam except that the upper 10 to 40 inches is slightly more clayey. These soils make up about 10 percent of each mapped area.

This Asher soil is used mostly for wheat, alfalfa hay, grain sorghum, and soybeans. It is also suited to other small grains, tame pasture grasses, native grasses, and hardwood trees.

The main concerns of management are surface wetness and the structure and fertility of the soil. Most crops generally grown on this soil produce large amounts of residue and can be grown continuously if the residue is returned to the soil and plant food is used. Capability unit IIw-1; Loamy Bottomland range site; pasture and hayland suitability group 2A; windbreaks tree suitability group 4; woodland suitability group 3o4.

Aydelotte Series

The Aydelotte series consists of deep, well drained, very gently sloping through sloping soils on uplands. These soils formed under a cover of grass in material weathered from clayey sediments or shale.

In a representative profile the surface layer is 6 inches of reddish brown loam. The subsoil to a depth of 63 inches is reddish brown and red clay.

Aydelotte soils have very slow permeability. Available water capacity is high.

Representative profile of Aydelotte loam, 2 to 5 percent slopes, about 450 feet south and 250 feet west of the **northeast corner of section 11, T. 11 N., R. 3 E.:**

Ap 0 to 6 inches; reddish brown (5YR 5/4) loam, dark reddish brown (5YR 3/4) when moist; weak medium granular structure; hard, friable; slightly acid; abrupt smooth boundary.

B21t 6 to 22 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) when moist; moderate fine blocky and subangular blocky structure; very hard, very firm; vertical faces of peds coated with dark brown (7.5YR 4/2) silt loam; clay films on faces of peds; neutral; gradual wavy boundary.

B22t 22 to 38 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) when moist; moderate medium and fine blocky structure; very hard, very firm; few nonintersecting slickensides in upper part; few iron-manganese oxide concretions; few vertical faces of peds coated with dark brown (7.5YR 4/2) silt loam; clay films on faces of peds; moderately alkaline; diffuse wavy boundary.

B3 38 to 63 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) when moist; weak medium and fine blocky structure; very hard, very firm; few nonintersecting slickensides in upper part; few shale fragments in lower part; few iron-manganese oxide concretions; clay films on faces of peds; few seams and bodies of soft calcium carbonate; calcareous; moderately alkaline.

The A1 or Ap horizon is reddish brown or brown. It is loam or clay loam and ranges from slightly acid through neutral. The B2t horizon is reddish brown, yellowish red, reddish yellow, red, or light reddish brown. It is clay, silty clay, or clay loam and ranges from slightly acid through moderately alkaline. The B3 horizon is red or yellowish red. It is clay, silty clay, or clay loam. The C horizon, where present, is clay or shale.

2—Aydelotte loam, 2 to 5 percent slopes. This soil is very gently sloping through gently sloping. It has the profile described as representative for the series.

Included with this soil in mapping are Renfrow soils, which make up about 15 percent of each mapped area; Kirkland soils, which make up about 10 percent; and Zaneis soils, which make up about 5 percent. Also included are soils that are similar to Aydelotte loam except that the subsoil is exposed at the surface or the solum is less than 60 inches thick. These soils make up about 10 percent of each mapped area.

This Aydelotte soil is used mostly for pasture grasses. It is also used for small grains, grain sorghum, and soybeans. It is also suited to native grasses.

The main concerns of management are the hazard of erosion, the slow intake of water, and the structure and fertility of the soil. Returning crop residue to the soil and using plant food are good management practices. Terraces with protected outlets, contour farming, and minimum tillage are needed where this soil is used for crops. Capability unit IVe-2; Claypan Prairie range site; pasture and hayland suitability group 8C; windbreaks tree suitability group 6; no woodland suitability group.

3—Aydelotte clay loam, 3 to 6 percent slopes, severely eroded. This is a gently sloping through sloping, severely eroded soil. It has a profile similiar to the one described as representative for the series except that the surface layer is clay loam. The surface layer has been thinned by erosion.

Included with this soil in mapping are soils that are similiar to Aydelotte clay loam except that the subsoil is exposed at the surface or the solum is less than 60 inches thick. These similar soils and shallow gullies together make up about 30 percent of each mapped area. Also included are Renfrow soils, which make up about 10 percent; Seminole soils, which make up 3 percent; and Vernon soils, which make up 2 percent.

This Aydelotte soil is used for range and pasture. The main concerns of management are the vigor of growing **grasses and the hazard of erosion. Capability unit VIe-1;** Eroded Clay range site; pasture and hayland suitability group 8F; windbreaks tree suitability group 9; no woodland suitability group.

Borrow Pits

4—Borrow Pits. This land type consists of areas from which the soil has been removed and used as fill material for roads. The parent material is typically exposed at the surface and ranges from clay through weathered shales.

These excavated areas are partly filled with water in most places. There is little or no vegetation. The parent

material and the soil exposed at the surface are variable from one area to another. Native grasses and improved pasture grasses can be planted in most of these areas. Capability unit VIIe-1; no range site; pasture and hayland suitability group 8F; windbreaks tree suitability group 9; no woodland suitability group.

Carytown Series

The Carytown series consists of deep, poorly drained, nearly level soils on uplands. These soils formed under a cover of grass in material weathered from clayey sediment, loamy sediment, or shale.

In a representative profile the surface and subsurface layers are 11 inches of gray silt loam. The upper part of the subsoil, to a depth of 30 inches, is dark gray clay. The middle part, to a depth of 40 inches, is grayish brown clay. The lower part, to a depth of 70 inches or more, is brown clay.

Carytown soils have very slow permeability. Available water capacity is high. A water table is below a depth of 1 foot during spring in most years.

Representative profile of Carytown silt loam, 0 to 1 percent slopes, about 400 feet north and 100 feet west of the southeast corner of section 20, T. 8 N., R. 5 E.:

A1—0 to 9 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) when moist; weak fine granular structure; slightly hard, very friable; neutral; clear smooth boundary.

A2—9 to 11 inches; gray (10YR 6/1) silt loam, very dark gray (10YR 3/1) when moist; massive; slightly hard, friable; neutral; abrupt smooth boundary.

B21t—11 to 30 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) when moist; weak coarse columnar breaking to moderate medium blocky structure; very hard, very firm; clay films on faces of peds; about 20 percent exchangeable sodium; mildly alkaline; clear smooth boundary.

B22—30 to 40 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) when moist; weak coarse and medium blocky structure; very hard, very firm; clay films on faces of peds; moderately alkaline; clear smooth boundary.

B3—40 to 70 inches; brown (10YR 5/3) clay, brown (10YR 4/3) when moist; common medium faint yellowish brown (10YR 5/4) mottles; weak coarse blocky structure; very hard, very firm; few crystals of gypsum below a depth of 50 inches; moderately alkaline.

The A1 or Ap horizon is dark gray, gray, or grayish brown. It ranges from medium acid through neutral. The A2 horizon ranges from medium acid through neutral. The B2 horizon is dark gray, gray, dark grayish brown, grayish brown, or brown. It is clay or silty clay and ranges from slightly acid through moderately alkaline. The B3 horizon is dark gray, gray, dark grayish brown, grayish brown, brown, yellowish brown, light yellowish brown, pale brown, or light brownish gray.

5—Carytown silt loam, 0 to 1 percent slopes. This is a nearly level soil. It has the profile described as representative for the series.

Included with this soil in mapping are soils that are similar to Carytown silt loam except that the surface layer is less than 6 inches thick. These soils make up about 5 percent of each mapped area. Also included are Kirkland and Seminole soils, each of which makes up about 10 percent.

This Carytown soil is used mostly for small grains and grain sorghum. It is also suited to alfalfa hay, soybeans, tame pasture grasses, and native grasses.

The main concerns of management are improving soil structure, reducing surface crusting, and maintaining soil fertility. Returning large amounts of crop residue to the soil and adding plant food are good management practices. Capability unit IIIw-2; Claypan Prairie range site; pasture and hayland suitability group 8D; windbreaks tree suitability group 9; no woodland suitability group.

Chickasha Series

The Chickasha series consists of deep, well drained, very gently sloping through sloping soils on uplands. These soils formed under a cover of grass in material weathered from sandstone.

In a representative profile the surface layer is 14 inches of dark grayish brown loam. The next layer to a depth of 22 inches is yellowish brown loam. The subsoil, to a depth of 53 inches, is strong brown and yellowish red sandy clay loam. It is underlain by light gray weathered sandstone to a depth of 65 inches or more.

Chickasha soils have moderate permeability. Available water capacity is high.

Representative profile of Chickasha loam, 1 to 3 percent slopes, about 1,350 feet south and 50 feet east of the northwest corner of section 3, T. 9 N., R. 3 E.:

A1—0 to 14 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; moderate fine granular structure; slightly hard, very friable; slightly acid; gradual smooth boundary.

B1—14 to 22 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) when moist; weak medium subangular blocky structure; slightly hard, friable; patchy clay films on faces of peds; slightly acid; gradual smooth boundary.

B21t—22 to 36 inches; strong brown (7.5YR 5/6) sandy clay loam, strong brown (7.5YR 4/6) when moist; common fine distinct red (2.5YR 5/6) mottles, streaks, and bodies; moderate medium subangular blocky structure; hard, friable; clay films on faces of peds; few organic stains on faces of peds; slightly acid; gradual smooth boundary.

B22t—36 to 48 inches; strong brown (7.5YR 5/8) sandy clay loam, strong brown (7.5YR 4/8) when moist; common medium distinct pink (7.5YR 7/4) and red (2.5YR 5/6) mottles and streaks; weak coarse subangular blocky structure; very hard, friable; clay films on faces of peds; slightly acid; gradual smooth boundary.

B3—48 to 53 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) when moist; common medium distinct pinkish gray (7.5YR 7/2) and red (2.5YR 5/6) mottles and streaks; weak coarse subangular blocky structure; hard, friable; few clay films on faces of peds; neutral; gradual smooth boundary.

C—53 to 65 inches; light gray (10YR 7/2) weathered sandstone; many medium distinct yellowish brown (10YR 5/6) and reddish brown (5YR 5/4) mottles.

The A1 or Ap horizon is brown, dark grayish brown, grayish brown, or dark brown. It is loam or fine sandy loam and is from medium acid through neutral. The B1 horizon is brown, dark brown, yellowish brown, dark grayish brown, or grayish brown. It is loam, sandy clay loam, or clay loam and ranges from medium acid through neutral. The B2t horizon is brown, strong brown, light yellowish brown, yellowish brown, reddish yellow, or brownish yellow. It is loam, sandy clay loam, or clay loam and ranges from medium acid through moderately alkaline. The B3

horizon is yellowish red, reddish yellow, yellowish brown, light yellowish brown, or brown. It is sandy clay loam or loam and ranges from medium acid through moderately alkaline. Depth to rippable sandstone is 40 to 60 inches.

6—Chickasha loam, 1 to 3 percent slopes. This soil is very gently sloping. It has the profile described as representative for the series.

Included with this soil in mapping are soils that are similar to Chickasha loam except that they are 20 to 40 inches thick over sandstone or they have gray mottles at a depth of 30 to 40 inches. These soils make up about 10 percent of each mapped area. Also included are Weatherford, Stephenville, Seminole, Renfrow, and Zaneis soils. These soils together make up about 10 percent of each mapped area.

Most of this Chickasha soil is used for tame pasture grasses and native grasses. It is also suited to small grains, alfalfa hay, grain sorghum, peanuts, and soybeans.

The main concerns of management are the hazard of erosion and the structure and fertility of the soil.

Most adapted crops can be grown if this soil is well managed. Returning crop residue to the soil and using plant food are good management practices. Terraces with protected outlets, contour farming, and minimum tillage are needed where row crops are grown. Capability unit IIe-1; Loamy Prairie range site; pasture and hayland suitability group 8A; windbreaks tree suitability group 8; no woodland suitability group.

7—Chickasha loam, 3 to 5 percent slopes. This soil is gently sloping. It has a profile similar to the one described as representative for the series.

Included with this soil in mapping are soils that are similar to Chickasha loam except that they are 20 to 40 inches thick over sandstone or they have gray mottles at a depth of 30 to 40 inches. These soils make up about 30 percent of each mapped area. Also included are Weatherford, Stephenville, Renfrow, and Seminole soils, which together make up about 10 percent of each mapped area.

Most of this Chickasha soil is used for tame pasture grasses and native grasses. It is also suited to small grains, grain sorghum, peanuts, and soybeans.

The main concerns of management are the hazard of erosion and the fertility and structure of the soil. Where row crops are grown, terraces and contour farming are needed. Large amounts of crop residue can be returned to the soil and plant food can be added to help maintain organic matter content and soil structure and to increase the intake rate of water. Where terraces are not used, a cropping system that includes only soil maintaining crops is needed. Capability unit IIIe-2; Loamy Prairie range site; pasture and hayland suitability group 8A; windbreaks tree suitability group 8; no woodland suitability group.

8—Chickasha and Zaneis soils, 1 to 8 percent slopes, severely eroded. These are very gently sloping through sloping, severely eroded soils. They have profiles similar to the ones described as representative for the Chickasha and Zaneis series except that the surface layer is fine sandy loam and is thinner and mixed with the subsoil in places. Chickasha and Zaneis soils occur without regularity of pattern.

Included with these soils in mapping are soils that are similar to Chickasha and Zaneis soils. In some of these similar soils, the surface layer is thinner or it is material from the subsoil. In others sandstone is at a depth of 20 to 40 inches. These similar soils make up about 20 percent of each mapped area. Also included are gullies that are 2 to 5 feet deep and 10 to 50 feet wide. These gullies make up about 20 percent of each mapped area. Teller, Norge, Seminole, and Vanoss soils together make up about 25 percent.

Chickasha and Zaneis soils are used mostly for native grasses. They are also suited to tame pasture grasses.

The main concerns of management are the vigor of growing grasses and the hazard of erosion. Capability unit VIe-4; Eroded Prairie range site; pasture and hayland suitability group 8F; windbreaks tree suitability group 8; no woodland suitability group.

Chigley Series

The Chigley series consists of deep, moderately well drained, gently sloping through strongly sloping soils on uplands. These soils formed under a cover of hardwood forest and grass in material weathered from conglomerate bedrock.

In a representative profile the surface layer is 5 inches of grayish brown gravelly sandy loam. The subsurface layer, to a depth of 16 inches, is brown gravelly sandy loam. The upper part of the subsoil, to a depth of 25 inches, is red gravelly sandy clay. The lower part, to a depth of 42 inches, is red clay. The underlying material is reddish brown gravelly clay to a depth of 60 inches or more.

Chigley soils have moderately slow permeability. Available water capacity is high. A water table is below a depth of 3 feet during spring in most years.

Representative profile of Chigley gravelly sandy loam, in an area of Chigley complex, 3 to 12 percent slopes, about 1,000 feet west and 25 feet south of the northeast corner of section 16, T. 6 N., R. 4 E.:

A1—0 to 5 inches; grayish brown (10YR 5/2) gravelly sandy loam, dark grayish brown (10YR 5/2) when moist; moderate fine granular structure; slightly hard, very friable; 30 percent gravel by volume; slightly acid; clear smooth boundary.

A2—5 to 16 inches; brown (7.5YR 5/4) gravelly sandy loam, brown (7.5YR 4/4) when moist; weak fine granular structure; slightly hard, very friable; 30 percent gravel by volume; slightly acid; clear wavy boundary.

B2t—16 to 25 inches; red (2.5YR 5/6) gravelly sandy clay; red (2.5YR 4/6) when moist; weak medium blocky structure; very hard, firm; clay films on faces of peds; 30 percent gravel by volume; strongly acid; clear wavy boundary.

B22t—25 to 42 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) when moist; weak medium blocky structure; extremely hard, extremely firm; clay films on faces of peds; medium acid; gradual smooth boundary.

C—42 to 60 inches; reddish brown (5YR 5/4) gravelly clay, reddish brown (5YR 4/4) when moist; weak coarse blocky structure; extremely hard, extremely firm; calcareous; moderately alkaline.

The A horizon is 25 to 30 percent gravel, by volume. The A1 horizon is grayish brown or brown. It ranges from medium acid through neutral. The A2 horizon ranges from medium acid through neutral. The B horizon is 5 to 30 percent gravel, by volume. The B21t horizon is red or yellowish red. It is gravelly sandy clay, sandy clay, or clay and ranges from strongly acid through slightly acid. The B22t horizon is red or yel lowish red. It ranges from medium acid through mildly alkaline. The C horizon is reddish brown or yellowish red. Depth to rippable con glomerate is 40 to 70 inches.

9—Chigley complex, 3 to 12 percent slopes. These soils are gently sloping through strongly sloping. They are in such an intricate pattern that it is impractical to map each kind of soil separately.

About 40 percent of the acreage is Chigley soils or very similar soils. Chigley soils have the profile described as representative for the series. The remaining soils are similar to Chigley soils except that the subsoil is loamy or clayey, with or without gravel.

Much of the acreage of these soils is being exploited for its gravel. Most of the remaining acreage is used for tame pasture grasses and native grasses or scrubby hardwood trees with a sparce understory of native grasses.

The main concerns of management are the vegetative cover in areas from which gravel has been removed and the vigor of growing grasses in others. Capability unit VIe-7; Sandy Savannah range site; pasture and hayland group 8A; windbreaks tree suitability group 8; no woodland suitability group.

Darnell Series

The Darnell series consists of shallow, well drained or somewhat excessively drained, sloping through strongly sloping soils on uplands. These soils formed under a cover of hardwood forest and in material weathered from sandstone.

In a representative profile the surface layer is 5 inches of brown fine sandy loam. The subsoil, to a depth of 14 inches, is light brown fine sandy loam. It is underlain by sandstone that extends to a depth of 18 inches or more.

Darnell soils have moderately rapid permeability. Available water capacity is moderate.

Representative profile of Darnell fine sandy loam, in an area of Stephenville-Darnell complex, 5 to 12 percent slopes, about 1,400 feet south and 400 feet east of the northwest corner of section 12, T 9 N., R. 2 E.:

A1 0 to 5 inches; brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) when moist; weak fine granular structure; slightly hard, very friable; medium acid; gradual smooth boundary.

B2 5 to 14 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) when moist; weak fine granular structure; slightly hard, very friable; slightly acid; gradual wavy boundary.

C 14 to 18 inches; yellowish red (5YR 5/6) sandstone.

The A1 horizon is brown, reddish brown, grayish brown, or dark grayish brown. It ranges from strongly acid through neutral. The B2 horizon is light brown, reddish brown, yellowish red, brown, pink, pale brown, very pale brown, or light yellowish brown. It ranges from strongly acid through neutral. Depth to rippable sandstone is 10 to 20 inches. In Pottawatomie County, Darnell soils are mapped only in complex with Stephenville soils.

Dougherty Series

The Dougherty series consists of deep, well drained, nearly level through sloping soils on uplands. These soils formed under a cover of hardwood forest and grass in material weathered from sandy and loamy sediments.

In a representative profile the surface layer is 6 inches of pinkish gray loamy fine sand. The subsurface layer, to a depth of 23 inches, is light brown loamy fine sand. The upper part of the subsoil, to a depth of 40 inches, is red sandy clay loam. The lower part, to a depth of 60 inches, is red fine sandy loam. It is underlain by yellowish red loamy fine sand to a depth of 72 inches or more.

Dougherty soils have moderate permeability. Available water capacity is moderate.

Representative profile of Dougherty loamy fine sand, 3 to 8 percent slopes, about 1,650 feet west and 200 feet **north of the southeast corner of section 22, T. 11 N., R. 4** E.:

A1—0 to 6 inches; pinkish gray (7.5YR 6/2) loamy fine sand, brown (7.5YR 4/2) when moist; weak fine granular structure; soft, very friable; medium acid; clear smooth boundary.

A2—6 to 23 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) when moist; single grained; soft, very friable; medium acid; abrupt smooth boundary.

B2t—23 to 40 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) when moist; weak medium subangular blocky structure; hard, friable; clay films on faces of peds and bridging sand grains; medium acid; gradual smooth boundary.

B3—40 to 60 inches; red (2.5YR 5/6) fine sandy loam, red (2.5YR 4/6) when moist; weak coarse subangular blocky structure; slightly hard, very friable; clay films on faces of some peds and bridging sand grains; strongly acid; clear wavy boundary.

C—60 to 72 inches; yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6) when moist; single grained; soft, very friable; medium acid.

The A1 or Ap horizon is pinkish gray, grayish brown, brown, light brownish gray, or pale brown. It ranges from medium acid through slightly acid. The A2 horizon is pinkish gray, light brown, pale brown, or very pale brown and ranges from medium acid through slightly acid. The B2t horizon is red, yellowish red, or reddish yellow. It is sandy clay loam or fine sandy loam and ranges from strongly acid through medium acid. The B3 horizon is red, yellowish red or reddish yellow. It is fine sandy loam or sandy clay loam and ranges from strongly acid through slightly acid. The C horizon is red, reddish yellow, or yellowish red. It is loamy fine sand or fine sandy loam and ranges from medium acid through neutral.

10—Dougherty loamy fine sand, 0 to 3 percent slopes. This soil is nearly level through very gently sloping. It has a profile similar to the one described as respresentative for the series.

Included with this soil in mapping are soils that are similar to Dougherty loamy fine sand but have gray mottles within 30 inches of the surface or a slightly more yellow subsoil. These soils make up about 20 percent of each mapped area. Also included are Eufaula soils, which make up about 10 percent, and Konawa soils, which make up 5 percent.

Most of this Dougherty soil is used for pasture. It is also suited to small grains, grain sorghum, peanuts, and native grasses.

The main concerns of management are the hazards of soil blowing, water erosion, and the fertility of the soil. The condition of the soil can be maintained or improved by systematically returning organic materials and by adding plant food. Erosion can be controlled if a vegetative cover is maintained or if crop residue is returned to the land during periods of critical high winds. Capability unit IIIe-4; Deep Sand Savannah range site; pasture and hayland suitability group 9A; windbreaks tree suitability group 8; no woodland suitability group.

11—Dougherty loamy fine sand, 3 to 8 percent slopes. This soil is gently sloping through sloping. It has the profile described as representative for the series (fig. 6).

Included with this soil in mapping are soils that are similar to Dougherty loamy fine sand but have gray mottles within 30 inches of the surface or a yellow subsoil. These soils make up about 7 percent of each mapped area. Also included are Konawa soils, which make up about 20 percent; Eufaula soils, which make up about 10 percent; and Noble soils, which make up about 3 percent.

This Dougherty soil is used mostly for tame pasture grasses. It is also suited to small grains, grain sorghum, peanuts, and native grasses.

The main concerns of management are the hazard of erosion and the structure and fertility of the soil. Large amounts of crop residue can be returned to the soil and plant food can be added to help maintain soil structure and fertility and to control erosion. Delaying spring tillage during the period of critical high winds helps to control soil blowing. Capability unit IVe-4; Deep Sand Savannah range site; pasture and hayland suitability group 9A; windbreaks tree suitability group 8; no woodland suitability group.

Eufaula Series

The Eufaula series consists of deep, somewhat excessively drained, nearly level through strongly sloping soils on uplands. These soils formed under a cover of hardwood forest and grass in material weathered from sandy sediment.

In a representative profile the surface layer is 4 inches of grayish brown fine sand. The subsurface layer, to a depth of 42 inches, is pinkish gray fine sand. The subsoil, to a depth of 72 inches, is alternating layers of light brown fine sand and yellowish red loamy fine sand and fine sandy loam that averages loamy fine sand.

Eufaula soils have rapid permeability. Available water capacity is moderate.

Representative profile of Eufaula fine sand, 3 to 12 percent slopes, about 1,200 feet east and 50 feet north of the southwest corner of section 30, T. 6 N., R. 5 E.:

A1—0 to 4 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) when moist; single grained; soft, loose; slightly acid; gradual smooth boundary.

A21—4 to 42 inches; pinkish gray (7.5YR 6/2) fine sand, brown (7.5YR 5/2) when moist; single grained; soft, loose; medium acid; clear wavy boundary.

A22&B2t—42 to 72 inches; light brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) when moist; single grained; soft, loose; medium acid; alternating layers of yellowish red (5YR 5/6) loamy fine sand and fine sandy loam that average loamy fine sand, yellowish red (5YR 4/6) when moist; single grained; slightly hard, friable; the yellowish red layers are 1/8 to 1 inch thick and 1 to 4 inches apart with clay films bridging the sand grains; strongly acid.

The A1 or Ap horizon is grayish brown, dark grayish brown, brown, or pale brown. It ranges from medium acid through neutral. The A2 horizon is very pale brown, light yellowish brown, light brown, pink, pinkish gray, or pale brown. It is fine sand or loamy fine sand and ranges from medium acid through neutral. The B2t horizon is yellowish red or reddish yellow. It is loamy fine sand or fine sandy loam that averages loamy fine sand and ranges from strongly acid through slightly acid. The B2t horizon is alternating layers between layers of material from the A2 horizon.

12—Eufaula fine sand, 0 to 3 percent slopes. This soil is nearly level through very gently sloping. It has a profile similar to the one described as representative for the series.

Included with this soil in mapping are soils that are similar to Eufaula fine sand except that the subsoil is sandy clay loam with grayish and reddish mottles. These soils make up about 5 percent of each mapped area. Also included are Dougherty soils, which make up about 10 percent.

This Eufaula soil is used mostly for tame pasture grasses. It is also suited to small grains, grain sorghum, peanuts, and native grasses.

The main concerns of management are the hazard of soil blowing and the fertility of the soil. Large amounts of residue can be returned to the soil and plant food can be added to help maintain soil fertility and to control soil blowing. Row direction and stripcropping at right angles to the prevailing winds are desirable practices for controlling soil blowing. Delaying spring tillage during the period of critical high winds also helps to control soil blowing. Capability unit IVs-2; Deep Sand Savannah range site; pasture and hayland suitability group 9B; windbreaks tree suitability group 7; no woodland suitability group.

13—Eufaula fine sand, 3 to 12 percent slopes. This soil is gently sloping through strongly sloping. It has the profile described as representative for the series.

Included with this soil in mapping are Dougherty and Konawa soils, which make up about 15 percent each of each mapped area; Galey soils, which make up about 3 percent; and Pulaski soils, which make up about 2 percent.

This Eufaula soil is used mostly for hardwood trees and native grasses. It is also suited to tame pasture grasses.

The main concern of grazing management is keeping the grasses growing vigorously. Capability unit VIe-9; Deep Sand Savannah range site; pasture and hayland suitability group 9B; windbreaks tree suitability group 7; no woodland suitability group.

Fluvents

14—Fluvents, 8 to 15 percent slopes. This unit consists of deep, well drained, strongly sloping through moderately steep soils on flood plains. Typically, the surface layer is 8 inches of pale brown very fine sandy loam. The underlying material to a depth of 60 inches is pale brown stratified fine sandy loam, very fine sandy loam, loam, and silt loam. These soils are subject to occasional flooding.

Included with these soils in mapping are Yahola soils, which make up about 5 percent of each mapped area.

These soils are suited to tame pasture grasses and native grasses.

The main concerns of management are establishing grasses in bare areas and keeping grasses growing vigorously in others. Capability unit VIe-3; Loamy Bottomland range site; pasture and hayland suitability group 2A; windbreaks tree suitability group 4; woodland suitability group 3o4.

Gaddy Series

The Gaddy series consists of deep, somewhat excessively drained, nearly level through very gently sloping soils on flood plains. These soils formed under a cover of hardwood forest and grass in material weathered from sandy and loamy sediments.

In a representative profile the surface layer is 8 inches of brown loamy fine sand. The underlying material to a depth of 60 inches is stratified light brown loamy fine sand and very pale brown fine sand.

Gaddy soils have rapid permeability. Available water capacity is moderate.

Representative profile of Gaddy loamy fine sand, about 2,100 feet west and 350 feet south of the northeast corner of section 28, T. 10 N., R. 4 E.:

Ap—0 to 8 inches; brown (7.5YR 5/4) loamy fine sand, brown (7.5YR 4/4) when moist; weak fine granular structure; slightly hard, very friable; calcareous; moderately alkaline; clear smooth boundary.

C1—8 to 20 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) when moist; single grained; soft, loose; common thin strata of brown (7.5YR 4/4) fine sandy loam; calcareous; moderately alkaline; clear smooth boundary.

C2—20 to 60 inches; very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) when moist; single grained; soft, loose; common thin strata of brown (10YR 5/3) loamy fine sand and fine sandy loam; calcareous; moderately alkaline.

The A1 or Ap horizon is brown, light brown, grayish brown, pale brown, or light yellowish brown. It ranges from mildly alkaline through moderately alkaline. The C horizon is light brown, pink, pale brown, or very pale brown. It is loamy fine sand or fine sand.

15—Gaddy loamy fine sand. This soil is nearly level through very gently sloping. It is occasionally flooded.

Included with this soil in mapping are soils that are similar to Gaddy loamy fine sand. Some of these similar soils are not calcareous in the upper 30 inches, and some have a dark brown or dark grayish brown surface layer. Others have a water table at a depth of 40 to 60 inches most of the year. These similar soils make up about 15 percent of each mapped area. Also included are Yahola soils, which make up about 10 percent, and Gracemore soils, which make up about 5 percent.

Most of this Gaddy soil is used for tame pasture grasses. It is also used for small grains, alfalfa hay, grain sorghum, peanuts, soybeans, native grasses, and hardwood trees.

The main concerns of management are occasional flooding, fertility of the soil, and overgrazing. Most crops grown on this soil produce large amounts of residue and can be grown continuously where the crop residue is returned to the soil and plant food is added. Capability unit IIIs-1; Sandy Bottomland range site; pasture and hayland suitability group 3A; windbreaks tree suitability group 2; woodland suitability group 3s6.

Galey Series

The Galey series consists of deep, moderately well drained, nearly level through very gently sloping soils on uplands. These soils formed under a cover of hardwood forest and grass in material weathered from loamy and sandy sediment.

In a representative profile the surface layer is 12 inches of brown fine sandy loam. The upper part of the subsoil, to a depth of 44 inches, is strong brown sandy clay loam. The lower part, to a depth of 65 inches or more, is light brown sandy clay loam.

Galey soils have moderate permeability. Available water capacity is high. A water table is at a depth of 4 to 6 feet at times during spring.

Representative profile of Galey fine sandy loam, 0 to 2 percent slopes, about 100 feet east and 100 feet north of the southwest corner of section 11, T. 11 N., R. 5 E.:

Ap—0 to 12 inches; brown (7.5YR 5/4) fine sandy loam; brown (7.5YR 4/4) when moist; weak fine granular structure; slightly hard, very friable; strongly acid; clear smooth boundary.

B21t—12 to 27 inches; strong brown (7.5YR 5/6) sandy clay loam; strong brown (7.5YR 4/6) when moist; moderate medium subangular blocky structure; hard, friable; clay films on faces of peds and bridging sand grains; medium acid; gradual smooth boundary.

B22t—27 to 44 inches; strong brown (7.5YR 5/6) sandy clay loam; strong brown (7.5YR 4/6) when moist; common medium faint reddish yellow (7.5YR 6/6) mottles; weak, medium subangular blocky structure; hard, friable; clay films on faces of peds and bridging sand grains; medium acid; gradual smooth boundary.

B3—44 to 65 inches; light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) when moist; many coarse distinct yellowish red (5YR 5/6) and pink (5YR 7/4) mottles; weak coarse subangular blocky structure; hard, friable; few pockets of clean sand grains; clay films bridging sand grains; strongly acid.

The A1 or Ap horizon is brown, grayish brown, light brownish gray, or pinkish gray. It ranges from strongly acid through slightly acid. The A2 horizon, where present, is pale brown fine sandy loam. The B2t horizon is strong brown, reddish yellow, yellowish brown, light yellowish brown, brownish yellow, or brown. It ranges from strongly acid through medium acid. The B3 horizon is light brown, reddish yellow, light yellowish brown, or brownish yellow. It is sandy clay loam or fine sandy loam and ranges from strongly acid through slightly acid.

16—Galey fine sandy loam, 0 to 2 percent slopes. This soil is nearly level through very gently sloping.

Included with this soil in mapping are soils that are similar to Galey fine sandy loam but have gray mottles at a depth of 20 to 30 inches or a very dark grayish brown surface layer. These similar soils make up about 20 percent of each mapped area. Also included are Konawa soils, which make up about 20 percent.

This Galey soil is used mostly for peanuts, small grains, and grain sorghum. It is also suited to alfalfa hay, soybeans, tame pasture grasses, and native grasses. About half of the acreage of this Galey soil is irrigated.

The main concerns of management are the hazard of erosion and the structure and fertility of the soil. Most crops that produce large amounts of residue can be grown continuously if the soil is well managed, if crop residue is returned to the soil, and if plant food is added. Some areas need terraces with protected outlets, contour farming, and minimum tillage where row crops are grown. Capability unit IIe-2; Sandy Savannah range site; pasture and hayland suitability group 8A; windbreaks tree suitability group 8; no woodland suitability group.

Gracemont Series

The Gracemont series consists of deep, somewhat poorly drained, nearly level soils on flood plains. These soils formed under a cover of hardwood forest and grass in material weathered from loamy sediment.

In a representative profile the surface layer is 10 inches of yellowish red fine sandy loam. The underlying material to a depth of 60 inches is yellowish red fine sandy loam with thin strata of loam, silt loam, loamy fine sand, and fine sand.

Gracemont soils have moderately rapid permeability. Available water capacity is high. These soils have a water table at a depth of 6 inches to 3 feet most of the year.

Representative profile of Gracemont fine sandy loam, about 600 feet east and 200 feet north of the southwest corner of section 3, T. 7 N., R. 4 E.:

A1—0 to 10 inches; yellowish red (5YR 5/6) fine sandy loam; yellowish red (5YR 4/6) when moist; weak, fine granular structure; slightly hard, very friable; calcareous; moderately alkaline; clear smooth boundary.

C—10 to 60 inches; yellowish red (5YR 5/6) fine sandy loam; yellowish red (5YR 4/6) when moist; massive; slightly hard, very friable; common thin strata of loam, silt loam, loamy fine sand, and fine sand as much as 3 inches thick; calcareous; moderately alkaline.

The A1 horizon is yellowish red or reddish brown. It ranges from mildly alkaline through moderately alkaline. The C horizon is yellowish red or reddish brown.

17—Gracemont fine sandy loam. This soil is nearly level. It is subject to frequent flooding.

Included with this soil in mapping are soils that are similar to Gracemont fine sandy loam except that they are slightly more clayey between depths of 10 and 40 inches. These included soils make up about 20 percent of each mapped area.

Most of this Gracemont soil is used for tame pasture grasses. It is also suited to native grasses and hardwood trees.

The main concerns of management are frequent flooding, fertility of the soil, and overgrazing. Capability unit Vw-2; Subirrigated range site; pasture and hayland suitability group 2B; windbreaks tree suitability group 1; woodland suitability group 3w4.

Gracemore Series

The Gracemore series consists of deep, somewhat poorly drained, nearly level through very gently sloping soils on flood plains. These soils formed under a cover of hardwood forest and grass in material weathered from sandy sediment.

In a representative profile the surface layer is 12 inches of reddish brown fine sand. The underlying material to a depth of 60 inches is light reddish brown fine sand with thin strata of more clayey materials.

Gracemore soils have moderately rapid permeability. Available water capacity is moderate. These soils have a water table at a depth of 6 inches to 3 feet most of the year.

Representative profile of Gracemore fine sand, about 1,600 feet north and 100 feet east of the southwest corner of section 7, T. 5 N., R 3 E.:

A—0 to 12 inches; reddish brown (5YR 5/3) fine sand, reddish brown (5YR 4/3) when moist; weak fine granular structure; soft, very friable; calcareous; mildly alkaline; clear smooth boundary.

C—12 to 60 inches; light reddish brown (5YR 6/4) fine sand, reddish brown (5YR 5/4) when moist; single grained; soft, loose; common thin strata of more clayey materials; calcareous; moderately alkaline.

The A1 horizon is reddish brown or brown. It ranges from mildly alkaline through moderately alkaline. The C horizon is light reddish brown, reddish brown, light brown, pale brown, or brown. It is fine sand or loamy fine sand with strata of more clayey materials.

18—Gracemore fine sand. This soil is nearly level through very gently sloping. It is subject to frequent flooding.

Included with this soil in mapping are soils that are similar to Gracemore fine sand except that the surface layer is clay loam or clay. Also included are Gracemont soils. These included soils each make up about 5 percent of each mapped area.

Most of this Gracemore soil is used for native grasses. It is suited to tame pasture grasses and hardwood trees.

The main concerns of management are frequent flooding, fertility of the soil, and overgrazing. Capability unit Vw-2; Subirrigated range site; pasture and hayland suitability group 3B; windbreaks tree suitability group 1; Woodland suitability group 3w5.

Gravel Pits

19—Gravel Pits. This land type consists of areas from which sand and gravel have been removed for use in construction.

These excavated areas are partly filled with water during some season of the year. The parent material, exposed

at the surface, ranges from loamy to sandy. Native grasses and improved pasture can be established in these areas. Cabability unit VIIe-2; no range site; pasture and hayland suitability group 8F; windbreaks tree suitability group 9; no woodland suitability group.

Harjo Series

The Harjo series consists of deep, poorly drained, nearly level soils on flood plains. These soils formed under a cover of hardwood forest and grass in material weathered from clayey and loamy sediment.

In a representative profile the surface layer is 10 inches of dark red clay. The underlying material to a depth of 65 inches is reddish brown and red clay.

Harjo soils have very slow permeability. Available water capacity is high. These soils have water ponded on the surface or a water table within 1 foot of the surface most of the year.

Representative profile of Harjo clay, about 400 feet west and 1,100 feet north of the southeast corner of section 8, T. 7 N., R. 5 E.:

A1—0 to 10 inches; dark red (2.5YR 3/6 when moist) clay; weak coarse platy structure in the upper part and weak medium subangular blocky structure in the lower part; extremely hard, firm; calcareous; moderately alkaline; clear smooth boundary.

C1—10 to 36 inches; reddish brown (2.5YR 4/4 when moist) clay; few fine faint weak red (2.5YR 4/2) mottles; moderate coarse subangular blocky parting to weak fine blocky structure; extremely hard, firm; calcareous; moderately alkaline; gradual smooth boundary.

C2—36 to 65 inches; red (2.5YR 4/6 when moist) clay; massive; extremely hard, firm; few thin strata of dark reddish brown (2.5YR 3/4 when moist) and weak red (10YR 4/4 when moist) clay loam; calcareous; moderately alkaline.

The A1 horizon is yellowish red, red, reddish brown, or dark red when moist. It ranges from mildly alkaline through moderately alkaline. The C horizon is reddish brown, weak red, dark reddish gray, red, or yellowish red when moist. It is clay or clay loam and includes loam and very fine sandy loam in the lower part.

20—Harjo clay. This soil is nearly level. It is subject to frequent flooding.

Included with this soil in mapping are soils that are similar to Harjo clay except that the water table is at a depth of 2 to 3 feet during most of the year. These soils make up about 15 percent of each mapped area. Also included are Gracemont soils, which make up about 5 percent.

About one-third of the acreage of this Harjo soil is used for tame pasture grasses. The remainder supports willow, green ash, saltcedar, seacoast sumpweed, or cattails or is under water for extended periods. It is also suited to hardwood trees and native grasses.

The main concerns of management are frequent flooding, surface wetness, poor drainage, fertility of the soil, and vigor of growing grasses. Capability unit VIIw-1; Wetland range site; pasture and hayland suitability group 1B; windbreaks tree suitability group 1; woodland suitability group 4w6.

Keokuk Series

The Keokuk series consists of deep, well drained, nearly level soils on flood plains. These soils formed under a cover of hardwood forest and grass in material weathered from loamy and sandy sediment.

In a representative profile the surface layer is 12 inches of dark grayish brown silt loam. The subsoil, to a depth of 24 inches, is brown silt loam. The underlying material to a depth of 65 inches is light brown very fine sandy loam.

Keokuk soils have moderate permeability. Available water capacity is high.

Representative profile of Keokuk silt loam, about 1,850 feet east and 200 feet south of the northwest corner of section 29, T. 11 N., R. 5 E.:

A1—0 to 12 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate fine granular structure; hard, very friable; slightly acid; gradual smooth boundary.

B2—12 to 24 inches; brown (7.5YR 5/2) silt loam, brown (7.5YR 4/2) when moist; weak medium subangular blocky structure; slightly hard, very friable; mildly alkaline; gradual smooth boundary.

C—24 to 65 inches; light brown (7.5YR 6/4) very fine sandy loam, brown (7.5YR 5/4) when moist; massive; slightly hard, very friable; few thin layers of silt loam, loam, and loamy very fine sand; few soft bodies of calcium carbonates at a depth of 29 inches and below; calcareous; moderately alkaline.

The A1 or Ap horizon is brown, dark grayish brown, or grayish brown. It ranges from slightly acid through mildly alkaline. The B2 horizon is brown, pinkish gray, light brown, pale brown, or light yellowish brown. It is silt loam, loam, or very fine sandy loam and ranges from slightly acid through mildly alkaline. The C horizon is pinkish gray, light brown, pink, pale brown, light yellowish brown, or very pale brown. It is very fine sandy loam, silt loam, or loam and ranges from mildly alkaline through moderately alkaline. Loamy very fine sand is below a depth of 40 inches in some areas.

21—Keokuk silt loam. This soil is nearly level. It is subject to rare flooding.

Included with this soil in mapping are soils that are similar to Keokuk silt loam. Some of these similar soils have a more clayey subsoil, and others have a surface layer of fine sandy loam and receive occasional flooding from side tributaries. These similar soils make up about 45 percent of each mapped area.

Most of this Keokuk soil is used for small grains, alfalfa hay, grain sorghum, peanuts, and soybeans. It is also suited to tame pasture grasses, native grasses, and hardwood trees.

The main concerns of management are the structure and fertility of the soil. Most crops generally grown on this soil produce large amounts of residue and can be grown continuously where the crop residue is returned to the soil and plant food is added. Capability unit I-1; Loamy Bottomland range site; pasture and hayland suitability group 2A; windbreak tree suitability group 4; Woodland suitability group 3o4.

Kirkland Series

The Kirkland series consists of deep, well drained, nearly level soils on uplands. These soils formed under a cover of grass in material weathered from clayey sediment or shale.

In a representative profile the surface layer is 7 inches of brown silt loam. The next layer, to a depth of 13 inches, is grayish brown silt loam. The upper part of the subsoil, to a depth of 48 inches, is brown silty clay. The lower part, to a depth of 82 inches or more, is yellowish red silty clay loam and red silty clay.

Kirkland soils have very slow permeability. Available water capacity is high.

Representative profile of Kirkland silt loam, 0 to 1 percent slopes, about 2,600 feet west and 750 feet south of the northeast corner of section 34, T. 11 N., R. 3 E.:

Ap—0 to 7 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) when moist; weak fine granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

A12—7 to 13 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate medium granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

B21t—13 to 33 inches; brown (10YR 4/3) silty clay, dark brown (10YR 3/3) when moist; moderate fine blocky structure; extremely hard, very firm; faces of peds are dark grayish brown (10YR 4/2); clay films on faces of peds; few fine iron-manganese oxide concretions; neutral; gradual smooth boundary.

B22t—33 to 48 inches; brown (7.5YR 4/4) silty clay, dark brown (7.5YR 3/4) when moist; moderate medium blocky structure; extremely hard, very firm; clay films on faces of peds; common dark grayish brown (10YR 4/2) silt loam coatings on vertical faces of peds; few fine iron-manganese oxide concretions; mildly alkaline; gradual smooth boundary.

B31—48 to 61 inches; yellowish red (5YR 5/6) silty clay loam, yellowish red (5YR 4/6) when moist; moderate medium blocky structure; extremely hard, firm; few faces of peds are reddish brown (5YR 5/4); clay films on faces of peds; few fine iron-manganese oxide concretions; moderately alkaline; diffuse smooth boundary.

B32—61 to 82 inches; red (2.5YR 5/6) silty clay, red (2.5YR 4/6) when moist; moderate coarse blocky structure; extremely hard, very firm; clay films on faces of peds; few iron-manganese oxide concretions; moderately alkaline.

The A1 or Ap horizon is grayish brown, dark grayish brown, or brown. It ranges from slightly acid through neutral. The B2t horizon is dark grayish brown or brown. It is clay or silty clay and ranges from neutral through mildly alkaline. The B3 horizon is yellowish red or red. It is silty clay, clay, or clay loam.

22—Kirkland silt loam, 0 to 1 percent slopes. This is a nearly level soil.

Included with this soil in mapping are soils that are similar to Kirkland silt loam but have grayish mottles at a depth of 30 to 40 inches or a surface layer more than 14 inches thick.

This Kirkland soil is used mostly for small grains, grain sorghum, and annual hay crops. It is also suited to alfalfa hay, soybeans, tame pasture grasses, and native grasses.

The main concerns of management are the slow intake of water and the structure and fertility of the soil. Large amounts of residue can be returned to the soil and plant food can be added to help maintain soil structure and soil fertility and to increase the intake rate of water. Capability unit IIs-1; Claypan Prairie range site; pasture and hayland suitability group 8C; windbreaks tree suitability group 6; no woodland suitability group.

Konawa Series

The Konawa series consists of deep, well drained, nearly level through sloping soils on uplands. These soils formed under a cover of hardwood forest and grass in material weathered from loamy and sandy sediment.

In a representative profile the surface layer is 6 inches of grayish brown loamy fine sand. The subsurface layer, to a depth of 14 inches, is very pale brown loamy fine sand. The upper part of the subsoil, to a depth of 38 inches, is yellowish red sandy clay loam. The lower part, to a depth of 54 inches, is yellowish red fine sandy loam. The underlying material to a depth of 70 inches is yellowish red loamy fine sand.

Konawa soils have moderate permeability. Available water capacity is high.

Representative profile of Konawa loamy fine sand, 3 to 8 percent slopes, about 700 feet south and 100 feet west of the northeast corner of section 36, T. 6 N., R. 4 E.:

Ap—0 to 6 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) when moist; weak fine granular structure; slightly hard, very friable; slightly acid; clear smooth boundary.

A2—6 to 14 inches; very pale brown (10YR 7/3) loamy fine sand, brown (10YR 5/3) when moist; single grained; soft, very friable; medium acid; clear smooth boundary.

B2t—14 to 38 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) when moist; moderate coarse prismatic breaking to weak medium subangular blocky structure; very hard, friable; clay films on faces of peds and bridging sand grains; medium acid; diffuse smooth boundary.

B3—38 to 54 inches; yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) when moist; weak coarse prismatic structure; hard, friable; medium acid; diffuse smooth boundary.

C—54 to 70 inches; yellowish red (5YR 5/8) loamy fine sand, yellowish red (5YR 4/8) when moist; single grained; slightly hard, friable; medium acid.

The A1 or Ap horizon is grayish brown, brown, light brown, or light brownish gray. It is loamy fine sand or fine sandy loam and ranges from medium acid through slightly acid. The A2 horizon is very pale brown, light brown, pinkish gray, or light brownish gray. It is loamy fine sand or fine sandy loam and ranges from medium acid through slightly acid. The B2t horizon is yellowish red, reddish yellow, reddish brown, or red. It is sandy clay loam or fine sandy loam and ranges from strongly acid through medium acid. The B3 horizon is yellowish red, reddish yellow, reddish brown, or red. It is fine sandy loam, sandy clay loam, or loamy fine sand and ranges from strongly acid through medium acid. The C horizon is yellowish red, reddish yellow, reddish brown, or red. It is loamy fine sand or fine sandy loam and ranges from strongly acid through neutral.

23—Konawa loamy fine sand, 3 to 8 percent slopes. This soil is gently sloping through sloping. It has the profile described as representative for the series.

Included with this soil in mapping are soils that are similar to Konawa loamy fine sand except that the subsoil is slightly more clayey or the clay content in the subsoil does not decrease within 60 inches of the surface. These

similar soils make up about 10 percent of each mapped area. Also included are Dougherty soils, which make up about 15 percent, and Weatherford soils, which make up about 10 percent.

Most of this Konawa soil is used for tame pasture grasses, small grains, and grain sorghum. It is also suited to native grasses.

The main concerns of management are the hazard of erosion and the structure and fertility of the soil. Large amounts of crop residue can be returned to the soil and plant food can be added to help maintain soil structure and fertility and to control erosion. Delaying spring tillage during periods of critical high winds also helps control soil blowing. Capability unit IVe-4; Deep Sand Savannah range site; pasture and hayland suitability group 9A; windbreaks tree suitability group 8; no woodland suitability group.

24—Konawa fine sandy loam, 0 to 3 percent slopes. This soil is nearly level through very gently sloping. It has a profile similar to the one described as representative for the series except that the surface and subsurface layers are fine sandy loam.

Included with this soil in mapping are soils that are similar to Konawa fine sandy loam except that the subsoil is slightly acid and some soils are underlain by shale at a depth of 40 to 60 inches. These soils make up about 25 percent of each mapped area. Also included are Galey soils, which make up about 5 percent; Weatherford soils, which make up about 4 percent; and Teller and Vanoss soils, which make up about 3 percent each.

This Konawa soil is used mostly for small grains, peanuts, and grain sorghum. it is also suited to alfalfa hay, soybeans, tame pasture grasses, and native grasses.

The main concerns of management are the hazard of erosion and the structure and fertility of the soil. Most crops that produce large amounts of residue can be grown continuously if the soil is well managed and the crop residue is returned to the soil and plant food is added. Terraces with protected outlets, contour farming, and minimum tillage are needed where row crops are grown. Capability unit IIe-2; Sandy Savannah range site; pasture and hayland suitability group 8A; windbreaks tree suitability group 8; no woodland suitability group.

25—Konawa fine sandy loam, 3 to 5 percent slopes. This soil is gently sloping. It has a profile similar to the one described as representative for the series except that the surface and subsurface layers are fine sandy loam.

Included with this soil in mapping are soils that are similar to Konawa fine sandy loam except that the surface layer is reddish brown or yellowish red or the subsoil is exposed at the surface. These soils make up about 25 percent of each mapped area. Also included are Weatherford soils, which make up about 5 percent, and a few small areas of Galey and Stephenville soils.

This Konawa soil is used mostly for tame pasture grasses, small grains, grain sorghum, and peanuts. It is also suited to soybeans and native grasses.

The main concerns of management are the hazard of erosion and the structure and fertility of the soil. Where row crops are grown, terraces and contour farming are needed. Large amounts of residue can be returned to the soil and plant food can be added to help maintain soil structure and fertility and to increase the intake rate of water. Where terraces are not used, a cropping system that includes only soil maintaining crops is needed. Capability unit IIIe-3; Sandy Savannah range site; pasture and hayland suitability group 8A; windbreaks tree suitability group 8; no woodland suitability group.

26—Konawa fine sandy loam, 3 to 8 percent slopes, severely eroded. This is a gently sloping through sloping, severely eroded soil. It has a profile similar to the one described as representative for the series except that the surface and subsurface layers are fine sandy loam and have been thinned by erosion.

Included with this soil in mapping are gullies (fig. 7) and areas of Konawa soils in which the subsoil is exposed at the surface. These inclusions comprise about 30 percent of each mapped area. Also included are Weatherford soils, which make up about 4 percent, and Eufaula soils, which make up about 3 percent.

This soil is used mostly for tame pasture grasses or native grasses.

The main concerns of management are the hazard of erosion and the vigor of growing grasses. Capability unit VIe-5; Eroded Sandy Savannah range site; pasture and hayland suitability group 8F; windbreaks tree suitability group 8; no woodland suitability group.

Latanier Series

The Latanier series consists of deep, somewhat poorly drained, nearly level soils on flood plains. These soils formed under a cover of hardwood forest and grass in material weathered from clayey and loamy sediment.

In a representative profile the surface layer is 8 inches of dark reddish gray silty clay loam. The subsoil, to a depth of 23 inches, is reddish brown silty clay. The underlying material to a depth of 72 inches is stratified pink loam and very fine sandy loam with thin strata of other textures.

Latanier soils have very slow permeability. Available water capacity is high. These soils have a water table at a depth of 2 to 3 feet during parts of winter and spring.

Representative profile of Latanier silty clay loam, about 25 feet west and 50 feet south of the northeast corner of section 25, T. 11 N., R 2 E.:

Ap—0 to 8 inches; dark reddish gray (5YR 4/2) silty clay loam, dark reddish brown (5YR 3/2) when moist; weak fine granular structure; very hard, firm; calcareous; moderately alkaline.

B2—8 to 23 inches; reddish brown (5YR 4/3) silty clay, dark reddish brown (5YR 3/3) when moist; strong medium blocky and subangular blocky structure; very hard, firm; few slickensides; calcareous; moderately alkaline; clear smooth boundary.

IIC1—23 to 35 inches; pink (5YR 7/3) loam, reddish brown (5YR 5/3) when moist; massive; hard, friable; few spots of soft calcium carbonate; calcareous; moderately alkaline; abrupt smooth boundary.

IIC1—35 to 72 inches; pink (5YR 7/3) very fine sandy loam, light reddish brown (5YR 6/3) when moist; few fine brownish mottles; massive; slightly hard, very friable; common strata of pink (5YR 7/4) loamy fine sand and reddish brown (5YR 5/3) silty clay loam as much as 3 inches thick; calcareous; moderately alkaline.

The A1 or Ap horizon is dark reddish gray, reddish brown, or dark brown. It ranges from neutral through moderately alkaline. The B2 horizon is silty clay or clay and ranges from mildly alkaline through moderately alkaline. The IIC horizon is pink, pinkish gray, light reddish brown, or light brown. It is loam or very fine sandy loam with thin strata of more sandy or more clayey material.

27—Latanier silty clay loam. This soil is nearly level. It is subject to occasional flooding.

Included with this soil in mapping are soils that are similar to Latanier silty clay loam except that the surface layer is light reddish brown or the combined thickness of the surface layer and subsoil is more than 40 inches. These similar soils make up about 25 percent of each mapped area. Also included are Yahola soils, which make up about 15 percent of each mapped area.

Latanier soil is used mostly for tame pasture grasses, grain sorghum, and annual hay crops. It is also suited to small grains, alfalfa hay, soybeans, native grasses, and hardwood trees.

The main concerns of management are occasional flooding, surface wetness, drainage, and the structure and fertility of the soil. Most crops grown on this soil produce large amounts of residue and can be grown continuously where the crop residue is returned to the soil and plant food is added. Capability unit IIIw-1; Heavy Bottomland range site; pasture and hayland suitability group 1A; **windbreaks tree suitability group 5; woodland suitability** group 2w6.

Lela Series

The Lela series consists of deep, somewhat poorly drained, nearly level soils on flood plains. These soils formed under a cover of hardwood forest and grass in material weathered from clayey sediment.

In a representative profile the surface layer is 7 inches of very dark gray silty clay. The next layer, to a depth of 24 inches, is dark reddish gray silty clay. The underlying material to a depth of 72 inches is brown silty clay.

Lela soils have very slow permeability. Available water capacity is high.

Representative profile of Lela silty clay, about 2,000 feet west and 2,000 feet south of the northeast corner of section 4, T. 11 N., R. 2 E.:

Ap—0 to 7 inches; very dark gray (5YR 3/1) silty clay, black (5YR 2/1) when moist; moderate fine granular structure; hard, firm; mildly alkaline; gradual smooth boundary.

A12—7 to 24 inches; dark reddish gray (5YR 4/2) silty clay, dark reddish brown (5YR 3/2) when moist; moderate medium blocky and subangular blocky structure; very hard, very firm; nearly vertical streaks of very dark gray (5YR 3/1) silty clay less than one-half inch wide; faces of peds are dark gray (5YR 4/1); many intersecting slickensides; calcareous; mildly alkaline; diffuse smooth boundary.

AC—24 to 72 inches; brown (7.5YR 5/2) silty clay, dark brown (7.5YR 4/2) when moist; moderate medium blocky and subangular blocky structure; very hard, very firm; many intersecting slickensides; thin loamy strata below a depth of 34 inches have been rearranged from horizontal to uncomforming angles; calcareous; moderately alkaline.

The A1 or Ap horizon is very dark gray, dark gray, very dark grayish brown, dark grayish brown, dark reddish gray, dark reddish brown, reddish gray, or brown. It ranges from neutral through mildly alkaline. The AC horizon is brown, dark reddish gray, reddish gray, reddish brown, or grayish brown. It is silty clay or clay.

28—Lela silty clay. This soil is nearly level. It is subject to occasional flooding.

Included with this soil in mapping are soils that are similar to Lela silty clay but have loamy sediment at a depth of 27 to 40 inches or a slightly less clayey surface layer. These similar soils make up about 25 percent of each mapped area. Also included are Miller and Asher soils, each of which makes up about 5 percent.

This Lela soil is used mostly for small grains, alfalfa hay, or grain sorghum. It is also suited to soybeans, tame pasture grasses, and native grasses.

The main concerns of management are occasional flooding, surface wetness, drainage, and the structure and fertility of the soil. Most crops grown on this soil produce large amounts of residue and can be grown continuously where the crop residue is returned to the soil and plant food is added. Capability unit IIIw-1; Heavy Bottomland range site; pasture and hayland suitability group 1A; windbreaks tree suitability group 5; woodland suitability group 3w6.

Miller Series

The Miller series consists of deep, moderately well drained, nearly level soils on flood plains. These soils formed under a cover of hardwood forest and grass in material weathered from clayey sediment.

In a representative profile the surface layer is 12 inches of reddish brown clay loam. The subsoil, to a depth of 48 inches, is reddish brown clay. The underlying material to a depth of 96 inches is reddish brown clay.

Miller soils have very slow permeability. Available water capacity is high.

Representative profile of Miller clay loam, about 150 feet east and 50 feet north of the southwest corner of section 4, T. 8 N., R. 4 E.:

A1—0 to 12 inches; reddish brown (5YR 5/3) clay loam, dark reddish brown (5YR 3/3) when moist; weak medium subangular blocky structure; very hard, firm; calcareous; moderately alkaline; clear smooth boundary.

B21—12 to 36 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) when moist; moderate medium blocky structure; extremely hard, very firm; few slickensides; streaks of reddish brown (5YR 5/3) clay loam on vertical faces of some peds; calcareous; moderately alkaline; clear smooth boundary.

B22—36 to 48 inches; reddish brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) when moist; moderate coarse blocky structure; extremely hard, very firm; few slickensides; few small bodies of reddish brown (5YR 5/4) clay; calcareous; moderately alkaline; clear smooth boundary.

C—48 to 96 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) when moist; massive; extremely hard, very firm; few fine soft iron-manganese bodies; calcareous; moderately alkaline.

The A1 or Ap horizon is reddish brown or dark reddish gray. It ranges from mildly alkaline through moderately alkaline. The B2 horizon is reddish brown or dark reddish brown. It ranges from mildly alkaline through moderately alkaline. The C horizon is red, reddish brown, or yellowish red.

29—Miller clay loam. This soil is nearly level. It is subject to occasional flooding.

Included with this soil in mapping are soils that are similar to Miller clay loam. Some of these similar soils are not calcareous at a depth of 10 to 20 inches, and some have loam or fine sandy loam recent sediment in the upper 30 inches. Others have horizons of salt accumulation. These similar soils make up about 17 percent of each mapped area. Also included are Port soils, which make up about 5 percent of each mapped area.

This Miller soil is used mostly for tame pasture grasses, small grains, grain sorghum, alfalfa hay, and annual hay crops. It is also suited to soybeans and native grasses.

The main concerns of management are occasional flooding, surface wetness, and the structure and fertility of the soil. Most crops grown on this soil produce large amounts of residue and can be grown continuously where the residue is returned to the soil and plant food is added. Capability unit IIIw-1; Heavy Bottomland range site; pasture and hayland suitability group 1A; windbreaks tree suitability group 5; no woodland suitability group.

Noble Series

The Noble series consists of deep, well drained, gently sloping through sloping soils on uplands. These soils formed under a cover of hardwood forest and grass in material weathered from loamy sediment.

In a representative profile the surface layer is 10 inches of reddish brown fine sandy loam. The subsoil, to a depth of 40 inches, is red fine sandy loam. The underlying material to a depth of 60 inches is red fine sandy loam.

Noble soils have moderately rapid permeability. Available water capacity is high.

Representative profile of Noble fine sandy loam, 3 to 8 percent slopes, about 600 feet north and 30 feet west of the southeast corner of section 22, T. 7 N., R. 2 E.:

A1—0 to 10 inches; reddish brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) when moist; moderate fine granular structure; slightly hard, very friable; slightly acid; clear smooth boundary.

B2—10 to 40 inches; red (2.5YR 4/6) fine sandy loam, dark red (2.5YR 3/6) when moist; weak coarse prismatic breaking to weak medium subanglar blocky structure; hard, very friable; medium acid; gradual smooth boundary.

C—40 to 60 inches; red (2.5YR 4/6) fine sandy loam, dark red (2.5YR 3/6) when moist; weak coarse prismatic breaking to weak coarse subangular blocky structure; hard, very friable; slightly acid.

The A1 or Ap horizon is reddish brown or brown and ranges from slightly acid through medium acid. The B2 horizon is red, reddish brown, or yellowish red and ranges from slightly acid through medium acid. The C horizon is red, reddish brown, or yellowish red and ranges from slightly acid through medium acid.

30—Noble fine sandy loam, 3 to 8 percent slopes. This is a gently sloping through sloping soil.

Included with this soil in mapping are soils that are similar to Noble fine sandy loam except that the subsoil is slightly more clayey or the surface layer is slightly darker. These soils make up about 25 percent of each mapped area. Also included are Teller soils, which make up about 5 percent.

This Noble soil is used mostly for tame pasture grasses and native grasses. It is also suited to small grains and grain sorghum.

The main concerns of management are the hazard of erosion and the structure and fertility of the soil. Large amounts of residue can be returned to the soil and plant food can be added to help maintain soil structure and fertility and to control erosion. Where crops are grown, terraces with protected outlets, contour farming, and minimum tillage are needed. Capability unit IVe-3; Sandy Savannah range site; pasture and hayland suitability group 8A; windbreaks tree suitability group 8; no woodland suitability group.

Norge Series

The Norge series consists of deep, well drained, very gently sloping through gently sloping soils on uplands. These soils formed under a cover of grass in material weathered from loamy sediment.

In a representative profile the surface layer is 12 inches of dark brown loam. The next layer, to a depth of 18 inches, is reddish brown loam. The subsoil to a depth of 60 inches is yellowish red and red clay loam.

Norge soils have moderately slow permeability. Available water capacity is high.

Representative profile of Norge loam, 3 to 5 percent slopes, about 1,600 feet north and 500 feet east of the southwest corner of section 18, T. 11 N., R. 3 E.:

A1—0 to 12 inches; dark brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) when moist; moderate fine granular structure; slightly hard, very friable; neutral; gradual smooth boundary.

B1—12 to 18 inches; reddish brown (5YR 4/4) loam, dark reddish brown (5YR 3/4) when moist; weak fine subangular blocky structure; hard, friable; slightly acid; clear smooth boundary.

B21t—18 to 32 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) when moist; weak medium subangular blocky structure; hard, firm; thin continuous clay films on faces of peds; slightly acid; gradual smooth boundary.

B22t—32 to 44 inches; red (2.5YR 5/6) clay loam, red (2.5YR 4/6) when moist; weak medium subangular blocky structure; hard, firm; thin continuous clay films on faces of peds; slightly acid; gradual smooth boundary.

B3—44 to 60 inches; red (2.5YR 5/6) clay loam, red (2.5YR 4/6) when moist; weak coarse subangular blocky structure; hard, firm; thin clay films on faces of some peds; slightly acid.

The A1 or Ap horizon is dark brown, brown, grayish brown, or dark grayish brown. It ranges from medium acid through neutral. The B1 horizon is reddish brown or brown. It is loam or silty clay loam and ranges from medium acid through slightly acid. The B2t horizon is yellowish red, red, or reddish brown. It is clay loam or silty clay loam and ranges from medium acid through neutral. The B3 horizon is red or yellowish red. It is clay loam or silty clay loam and ranges from slightly acid through moderately alkaline.

31—Norge loam, 1 to 3 percent slopes. This is a very gently sloping soil. Included with this soil in mapping are soils that are similar to Norge loam except that the subsoil is slightly more clayey. Also included are Teller soils. These included soils each make up about 10 percent of each mapped area.

This Norge soil is used mostly for tame pasture grasses, small grains, grain sorghum, annual hay crops, alfalfa hay, peanuts, soybeans, and native grasses.

The main concerns of management are the hazard of erosion and the structure and fertility of the soil. Most adapted crops can be grown if this soil is well managed. Returning crop residue to the soil and applying plant food are good management practices. Terracing with protected outlets, contour farming, and minimum tillage are needed where row crops are grown. Capability unit IIe-1; Loamy Prairie range site; pasture and hayland suitability group 8A; windbreaks tree suitability group 8; no woodland suitability group.

32—Norge loam, 3 to 5 percent slopes. This is a gently sloping soil. It has the profile described as representative for the series.

Included with this soil in mapping are soils that are similar to Norge loam. Some of these similar soils are slightly more clayey, and some have a surface layer that has been thinned by erosion. These similar soils make up about 20 percent of each mapped area.

This Norge soil is used mostly for tame pasture grasses, native grasses, small grains, grain sorghum, annual hay crops, peanuts, and soybeans.

The main concerns of management are the hazard of erosion and the structure and fertility of the soil. Where row crops are grown, terraces and contour farming are needed. Large amounts of crop residue can be returned to the soil and plant food can be added to help maintain soil structure and fertility and to increase the intake rate of water. Where terraces are not used, a cropping system that includes only soil maintaining crops is needed. Capability unit IIIe-2; Loamy Prairie range site; pasture and hayland suitability group 8A; windbreaks tree suitability group 8; no woodland suitability group.

Port Series

The Port series consists of deep, well drained, nearly level through very gently sloping soils on flood plains. These soils formed under a cover of hardwood forest and grass in material weathered from loamy sediment.

In a representative profile the surface layer is 23 inches of reddish brown loam. The subsoil, to a depth of 52 inches, is reddish brown clay loam and red loam. The underlying material to a depth of 72 inches is red loam.

Port soils have moderate permeability. Available water capacity is high.

Representative profile of Port loam, in an area of Port soils, about 2,300 feet west and 300 feet south of the northeast corner of section 30, T. 8 N., R. 5 E.:

A1—0 to 23 inches; reddish brown (5YR 4/3) loam, dark reddish brown (5YR 3/3) when moist; weak medium granular structure; hard, friable; neutral; clear smooth boundary.

B21—23 to 36 inches; reddish brown (2.5YR 4/4) clay loam, dark reddisl brown (2.5YR 3/4) when moist; weak medium subangular blocky structure; hard, friable; slightly acid; gradual smooth boundary.

B22—36 to 52 inches; red (2.5YR 4/6) loam, dark red (2.5YR 3/6) when moist; weak medium subangular blocky structure; hard, friable; slightly acid; gradual smooth boundary.

C—52 to 72 inches; red (2.5YR 4/6) loam, dark red (2.5YR 3/6) when moist; massive; hard, friable; few soft spots of calcium carbonates; calcareous; moderately alkaline.

The A1 or Ap horizon is brown, dark brown, dark reddish gray, weak red, reddish gray, reddish brown, or dark reddish brown. It is loam, fine sandy loam, or silt loam. It ranges from medium acid through mildly alkaline. The B2 horizon is reddish brown, red, dark brown, dark reddish gray, yellowish red, or strong brown. It is clay loam, loam, or silty clay loam and ranges from slightly acid through moderately alkaline. The C horizon is red, reddish brown, dark brown, dark reddish gray, yellowish red, or strong brown. It is loam, clay loam, or silty clay loam.

33—Port loam. This soil is nearly level through very gently sloping. It has a profile similar to the one described as representative for the series except that most areas have up to 20 inches of recent, lighter colored loam over the darker colored horizons. It is subject to occasional flooding.

Included with this soil in mapping are soils that are similar to Port loam. Some of these similar soils do not have a dark colored surface horizon, and some have a dark colored surface horizon less than 20 inches thick. Others are slightly more sandy at a depth of 10 to 40 inches. These similar soils make up about 35 percent of each mapped area. Also included are Miller soils, which make up about 5 percent, and inextensive areas of soils that have fine sandy loam at a depth of 0 to 40 inches.

Port loam is used mostly for tame pasture grasses, alfalfa hay, small grains, and grain sorghum. It is also suited to peanuts, soybeans, native grasses, or hardwood trees.

The main concerns of management are occasional flooding and the structure and fertility of the soil. Most crops generally grown on this soil produce large amounts of residue and can be grown continuously where the crop residue is returned to the soil and plant food is added. Capability unit IIw-1; Loamy Bottomland range site; pasture and hayland suitability group 2A; windbreaks tree suitability group 4; woodland suitability group 3o4.

34—Port soils. These soils are nearly level through very gently sloping in narrow areas along stream channels. These soils have the profile described as representative for the series. In some places, the surface layer is fine sandy loam or silt loam. These soils are subject to frequent flooding.

Included with these soils in mapping are soils that are similar to Port soils except that the dark colored surface layer is less than 20 inches thick. These soils make up about 5 percent of each mapped area. Also included are stream channels, which make up about 15 percent, and Pulaski and Yahola soils, each of which makes up about 5 percent.

Port soils are used mostly for tame pasture grasses, native grasses, or hardwood trees.

The main concerns of management are frequent flooding, the fertility of the soils, and overgrazing. Capability unit Vw-1; Loamy Bottomland range site; pasture and hayland suitability group 2A; windbreaks tree suitability group 4; woodland suitability group 3o4.

Pulaski Series

The Pulaski series consists of deep, well drained, nearly level through very gently sloping soils on flood plains. These soils formed under a cover of hardwood forest and grass in material weathered from loamy sediment.

In a representative profile the surface layer is 18 inches of red fine sandy loam. The underlying material to a depth of 60 inches is red fine sandy loam and reddish brown loam.

Pulaski soils have moderately rapid permeability. Available water capacity is high.

Representative profile of Pulaski fine sandy loam, about 600 feet north and 100 feet west of the southeast corner of section 28, T. 9 N., R. 3 E.:

A1—0 to 18 inches; red (2.5YR 5/6) fine sandy loam, dark red (2.5YR 3/6) when moist; weak fine granular structure; hard, very friable; few thin strata of loamy fine sand in lower part; slightly acid; clear smooth boundary.

C1—18 to 50 inches; red (2.5YR 5/6) fine sandy loam, red (2.5YR 4/6) when moist; massive; hard, very friable; common strata of reddish brown (5YR 4/4) loamy fine sand as much as 4 inches thick; few strata of reddish brown (5YR 4/3) very fine sandy loam and loam as much as 1 inch thick; slightly acid; clear smooth boundary.

Ab—50 to 60 inches; reddish brown (2.5YR 4/4) loam, dark reddish brown (2.5YR 3/4) when moist; moderate fine subangular blocky structure; very hard, friable; neutral.

The A1 or Ap horizon is red, reddish brown, or brown. It ranges from medium acid through neutral. The C horizon is red, reddish brown, light reddish brown, yellowish red, reddish yellow, or brown. It ranges from medium acid through mildly alkaline. The Ab horizon, where present, is reddish brown or brown. It ranges from neutral through mildly alkaline.

35—Pulaski fine sandy loam. This soil is nearly level through very gently sloping. It is subject to occasional flooding.

Included with this soil in mapping are soils that are similar to Pulaski fine sandy loam but have a water table at a depth of 40 to 60 inches most of the year or slightly more sand at a depth of 10 to 40 inches. These soils make up about 10 percent of each mapped area. Also included are Yahola soils, which make up about 5 percent; Port soils, which make up about 3 percent; and Miller soils, which make up about 2 percent.

This Pulaski soil is used mostly for pasture grasses, native grasses, small grains, and alfalfa hay. It is also suited to grain sorghum, peanuts, soybeans, and hardwood trees.

The main concerns of management are occasional flooding and the structure and fertility of the soil. Most crops grown on this soil produce large amounts of residue, and they can be grown continuously where the crop residue is returned to the soil and plant food is added. Capability unit IIw-2; Loamy Bottomland range site; pasture and hayland suitability group 2A; windbreaks tree suitability group 3; woodland suitability group 3o4.

Renfrow Series

The Renfrow series consists of deep, well drained, very gently sloping through gently sloping soils on uplands. These soils formed under a cover of grass in material weathered from clayey sediment or shale.

In a representative profile the surface layer is 8 inches of dark brown silt loam. The next layer, to a depth of 12 inches, is dark brown silty clay loam. The subsoil to a depth of 72 inches is brown and yellowish red clay.

Renfrow soils have very slow permeability. Available water capacity is high.

Representative profile of Renfrow silt loam, 1 to 3 percent slopes, about 1,450 feet east and 300 feet north of the southwest corner of section 19, T. 11 N., R. 4 E.:

A1—0 to 8 inches; dark brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) when moist; moderate fine granular structure; hard, friable; slightly acid; gradual smooth boundary.

B1—8 to 12 inches; dark brown (7.5YR 4/3) silty clay loam, dark brown (7.5YR 3/3) when moist; moderate fine subangular blocky breaking to moderate medium granular structure; hard, friable; slightly acid; clear smooth boundary.

B21t—12 to 36 inches; brown (7.5YR 5/3) clay, dark brown (7.5YR 4/3) when moist; moderate medium blocky structure; very hard, very firm; clay films on faces of peds; few fine iron-manganese oxide concretions; neutral; gradual smooth boundary.

B22t—36 to 72 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) when moist; moderate coarse blocky structure; very hard, very firm; clay films on faces of peds; few fine iron-manganese oxide concretions; few slickensides; mildly alkaline.

The A1 or Ap horizon is dark brown, brown, dark reddish gray, dark grayish brown, reddish brown, or grayish brown. It ranges from slightly acid through neutral. The B1 horizon is dark brown, reddish gray, dark reddish gray, reddish brown, or brown. It is silty clay loam or clay loam and ranges from slightly acid through neutral. The B2t horizon is brown, yellowish red, reddish brown, or red. It is clay, silty clay, or silty clay loam and ranges from slightly acid through moderately alkaline. The B3 horizon, where present, is red or yellowish red clay, silty clay, or silty clay loam. The C horizon, where present, is clayey sediment or shale.

36—Renfrow silt loam, 1 to 3 percent slopes. This is a very gently sloping soil. It has the profile described as representative for the series.

Included with this soil in mapping are soils that are similar to Renfrow silt loam but have gray mottles at a depth of 30 to 40 inches. These soils make up about 5 percent of each mapped area. Also included are Kirkland soils, which make up about 20 percent; Aydelotte and Chickasha soils, each of which makes up 3 percent; and Zaneis and Norge soils, each of which makes up 2 percent.

This Renfrow soil is used mostly for tame pasture grasses, native grasses, small grains, grain sorghum, and annual hay crops. It is also suited to soybeans.

The main concerns of management are the hazard of erosion, slow intake of water, and the structure and fertility of the soil. Most adapted crops can be grown if this

soil is well managed. Returning crop residue to the soil and applying plant food are good management practices. Terracing with protected outlets, contour farming, and minimum tillage are needed where row crops are grown. Capability unit IIIe-1; Claypan Prairie range site; pasture and hayland suitability group 8C; windbreaks tree suitability group 6; no woodland suitability group.

37—Renfrow silt loam, 3 to 5 percent slopes. This is a gently sloping soil. It has a profile similar to the one described as representative for the series.

Included with this soil in mapping are soils that are similar to Renfrow silt loam except that the surface layer and the next layer are medium acid or the depth to shale is 40 to 60 inches. These soils make up about 10 percent of each mapped area. Also included are Vernon soils, which make up about 10 percent; Zaneis and Chickasha soils, each of which makes up 3 percent; and Norge and Teller soils, each of which makes up 2 percent.

This Renfrow soil is used mostly for tame pasture grasses, native grasses, small grains, and annual hay crops. It is also suited to grain sorghum and soybeans.

The main concerns of management are the hazard of erosion, slow intake of water, and the structure and fertility of the soil. Returning crop residue to the soil and adding plant food are good management practices. Terraces with protected outlets, contour farming, and minimum tillage are needed where this soil is used for crops. Capability unit IVe-2; Claypan Prairie range site; pasture and hayland suitability group 8C; windbreaks tree suitability group 6; no woodland suitability group.

Sayers Series

The Sayers series consists of deep, somewhat excessively drained, nearly level through very gently sloping soils on flood plains. These soils formed under a cover of hardwood forest and grass in material weathered from sandy and loamy sediment.

In a representative profile the surface layer is 10 inches of brown loamy fine sand. The next layer, to a depth of 16 inches, is pale brown loamy fine sand. The underlying material to a depth of 60 inches is very pale brown fine sand.

Sayers soils have moderately rapid to rapid permeability. Available water capacity is moderate.

Representative profile of Sayers loamy fine sand, in an area of Sayers complex, about 100 feet east and 100 feet south of the northwest corner of section 8, T. 10 N., R. 3 E.:

A1—0 to 10 inches; brown (10YR 5/3) loamy fine sand; dark brown (10YR 3/3) when moist; weak, fine granular structure; slightly hard, very friable; mildly alkaline; clear smooth boundary.

A12—10 to 16 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 4/3) when moist; weak, fine granular structure; slightly hard, very friable; neutral; clear wavy boundary.

IIC1—16 to 45 inches; very pale brown (10YR 7/3) fine sand, brown (10YR 5/3) when moist; single grained; soft, loose; few thin strata of fine sandy loam; mildly alkaline; gradual smooth boundary.

IIC2—45 to 60 inches; very pale brown (10YR 7/3) fine sand; brown (10YR 5/3) when moist; single grained; soft, loose; few strata of loamy fine sand and fine sandy loam 1/2 inch to 2 inches thick; calcareous; mildly alkaline.

The A1 or Ap horizon is brown, grayish brown, pale brown, or light yellowish brown. It is loamy fine sand or fine sand and ranges from neutral through mildly alkaline. The IIC horizon is very pale brown, pale brown, or light yellowish brown. It is fine sand or loamy fine sand.

38—Sayers complex. These soils are nearly level through very gently sloping. They have the profile described as representative for the series, but the surface layer is fine sand in places. They are subject to occasional flooding.

About 65 percent of the acreage is Sayers soils. About 30 percent is soils that are similar to Sayers soils except that the surface layer is slightly darker colored or the underlying material is calcareous. Included in mapping are **Gaddy soils, which make up about 5 percent of eacn** mapped area.

Sayers soils are used mostly for alfalfa hay, small grains, and peanuts. They are also suited to grain sorghum, soybeans, tame pasture grasses, native grasses, and hardwood trees.

The main concerns of management are occasional flooding and the fertility of the soil. Most crops grown on this soil produce large amounts of residue and can be grown continuously where the crop residue is returned to the soil and plant food is applied. Capability unit IVs-1; Sandy Bottomland range site; pasture and hayland suitability group 3A; windbreaks tree suitability group 2; woodland suitability group 2o6.

Seminole Series

The Seminole series consists of deep, moderately well drained, very gently sloping through gently sloping soils on uplands. These soils formed under a cover of grass in material weathered from shale, loamy sediment, and clayey sediment.

In a representative profile the surface layer is 14 inches of grayish brown loam. The next layer, to a depth of 20 inches, is brown loam. The upper part of the subsoil, to a depth of 32 inches, is pale brown clay. The middle part, to a depth of 48 inches, is yellowish brown clay. The lower part, to a depth of 72 inches or more, is brown clay.

Seminole soils have slow permeability. Available water capacity is high. A perched water table is below a depth of 2 to 3 feet during spring in most years.

Representative profile of Seminole loam, 2 to 5 percent slopes, about 200 feet east and 50 feet south of the northwest corner of section 9, T. 10 N., R. 5 E.:

A1—0 to 14 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; moderate fine granular structure; hard, friable; medium acid; gradual wavy boundary.

B&A—14 to 20 inches; brown (10YR 5/3) loam, brown (10YR 4/3) when moist; few fine faint grayish brown (10YR 5/2) and common fine distinct yellowish red (5YR 5/6) and strong brown (7.5YR 5/6) mottles; moderate medium and fine subangular blocky structure; very hard, firm; few bodies of brown (7.5YR 4/4) clay loam; many fine

pores and roots; thin coatings of light brownish gray (10YR 6/2) and pale brown (10YR 6/3) silt loam on faces of peds; medium acid; gradual smooth boundary.

B21t—20 to 32 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) when moist; common fine and medium, prominent and distinct red (2.5YR 5/6), yellowish red (5YR 5/6), strong brown (7.5YR 5/6), yellowish brown (10YR 5/6), and grayish brown (10YR 5/2) mottles; moderate, medium prismatic breaking to moderate, medium subangular blocky structure; very hard, very firm; nearly continuous brown (10YR 5/3) clay films on faces of peds; few vertical faces of peds have thin light brownish gray (10YR 6/2) silt coatings; many fine roots on faces of peds; medium acid; gradual smooth boundary.

B22t—32 to 48 inches; yellowish brown (10YR 5/4) clay; dark yellowish brown (10YR 4/4) when moist; common coarse distinct brown (10YR 4/3), yellowish brown (10YR 5/6), and grayish brown (10YR 5/2) mottles; moderate coarse subangular blocky structure; extremely hard, very firm; dark grayish brown (10YR 4/2) and brown (10YR 4/3) clay films on faces of peds; few soft iron-manganese oxide bodies; moderately alkaline; diffuse smooth boundary.

B3—48 to 72 inches; brown (7.5YR 5/4) clay, brown (7.5YR 4/4) when moist; common fine and medium distinct grayish brown (10YR 5/2) and reddish yellow (7.5YR 6/6) mottles; weak coarse subangular blocky structure; extremely hard, very firm; dark grayish brown (10YR 4/2) and brown (10YR 4/3) clay films on faces of peds; few soft iron-manganese oxide bodies; few pitted calcium carbonate concretions; moderately alkaline.

The A1 or Ap horizon is grayish brown, dark grayish brown, or brown. It ranges from medium acid through neutral. The B part of the B&A horizon is brown, yellowish brown, pale brown, or grayish brown. It is silt loam, loam, or clay loam and ranges from medium acid through neutral. The A part is pale brown or light brownish gray silt loam or loam. It ranges from medium acid through neutral. The B2t horizon is brown, yellowish brown, pale brown, light yellowish brown, very pale brown or light olive brown. It is clay, silty clay, or clay loam and ranges from medium acid through moderately alkaline. The B3 horizon is brown, yellowish brown, light yellowish brown, very pale brown, or brownish yellow. It is clay, silty clay, or clay loam. The C horizon, where present, is similar in color to the B3 horizon. It is clay, clay loam, or shale.

39—Seminole loam, 0 to 2 percent slopes. This is a nearly level through very gently sloping soil. It has a profile similar to the one described as representative for the series.

Included with this soil in mapping are Carytown soils, which make up about 10 percent of each mapped area; Chickasha soils, which make up 4 percent; Vanoss soils, which make up 3 percent; and Teller soils, which make up 2 percent.

This Seminole soil is used mostly for wheat, grain sorghum, annual hay crops, and peanuts. It is also suited to other small grains, soybeans, tame pasture grasses, and native grasses.

The main concerns of management are the hazard of erosion and the structure and fertility of the soil. Most adapted crops can be grown if this soil is well managed. Returning crop residue to the soil and applying plant food are good management practices. Terracing with protected outlets, contour farming, and minimum tillage are needed where row crops are grown. Capability unit IIe-1; Loamy Prairie range site; pasture and hayland suitability group 8A; windbreaks tree suitability group 8; no woodland suitability group.

40—Seminole loam, 2 to 5 percent slopes. This is a very gently sloping through gently sloping soil. It has the profile described as representative for the series.

Included with this soil in mapping are soils that are similar to Seminole loam except that the surface layer is thinner. These soils make up about 10 percent of each mapped area. Also included are Chickasha soils, which make up about 10 percent, and Renfrow soils, which make up about 5 percent.

Most of the acreage of this soil is used for small grains, grain sorghum, annual hay crops, tame pasture grasses, or native grasses. It is also suited to peanuts and soybeans.

The main concerns of management are the hazard of erosion and the fertility and structure of the soil. Where row crops are grown, terraces and contour farming are needed. Large amounts of crop residue can be added to help maintain organic matter content and soil structure and to increase the intake rate of water. Where terraces are not used, a cropping system that includes only soil maintaining crops is needed. Capability unit IIIe-2; Loamy Prairie range site; pasture and hayland suitability group 8A; windbreaks tree suitability group 8; no woodland suitability group.

Stephenville Series

The Stephenville series consists of moderately deep, well drained, very gently sloping through strongly sloping soils on uplands. These soils formed under a cover of hardwood forest and grass in material weathered from sandstone.

In a representative profile the surface layer is 5 inches of brown fine sandy loam. The subsurface layer, to a depth of 12 inches, is light reddish brown fine sandy loam. The upper part of the subsoil, to a depth of 24 inches, is red sandy clay loam. The lower part, to a depth of 34 inches, is reddish brown fine sandy loam. It is underlain by weathered sandstone to a depth of 42 inches or more.

Stephenville soils have moderate permeability. Available water capacity is moderate.

Representative profile of Stephenville fine sandy loam, 1 to 3 percent slopes, about 300 feet west and 2,600 feet south of the northeast corner of section 13, T. 8 N, R. 4 E.:

A1—0 to 5 inches; brown (7.5YR 5/2) fine sandy loam, dark brown (7.5YR 4/2) when moist; weak fine granular structure; soft, very friable; strongly acid; clear wavy boundary.

A2—5 to 12 inches; light reddish brown (5YR 6/4) fine sandy loam, reddish brown (5YR 5/4) when moist; massive; soft, very friable; medium acid; clear smooth boundary.

B21t—12 to 24 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) when moist; weak medium subangular blocky structure; hard, friable; clay films on faces of peds; few bodies of light brown (7.5YR 6/4) and red (2.5YR 4/6); strongly acid; gradual wavy boundary.

B22t—24 to 34 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) when moist; weak medium subangular blocky structure; hard, friable; clay films on faces of peds; medium acid; gradual wavy boundary.

C—34 to 42 inches; reddish brown (5YR 5/4) weathered sandstone.

The A1 or Ap horizon is brown, light yellowish brown, grayish brown, dark grayish brown, dark brown, or reddish brown. It ranges from strongly acid through slightly acid. The A2 horizon is light reddish brown, brown, light brown, pale brown, reddish brown, or light yellowish

brown. It ranges from strongly acid through slightly acid. The B2t horizon is red, reddish brown, light red, yellowish red, or reddish yellow. It is sandy clay loam or fine sandy loam and ranges from strongly acid through medium acid. The B3 horizon, where present, is similar in color, texture, and reaction to the B2t horizon. The C horizon is reddish brown, yellowish red, red, or reddish yellow. Depth to rippable sandstone is 20 to 40 inches.

41—Stephenville fine sandy loam, 1 to 3 percent slopes. This soil is very gently sloping. It has the profile described as representative for the series.

Included with this soil in mapping are Weatherford soils, which make up about 20 percent of each mapped area; Windthorst soils, which make up about 4 percent; and Darnell and Chickasha soils, each of which makes up about 3 percent.

This Stephenville soil is used mostly for tame pasture grasses, native grasses, small grains, or peanuts. It is also suited to grain sorghum and soybeans.

The main concerns of management are the hazard of erosion and the structure and fertility of the soil. Most crops that produce large amounts of residue can be grown continuously if the soil is well manage, crop residue is returned to the soil, and plant food is added. Terraces with protected outlets, contour farming, and minimum tillage are needed where row crops are grown. Capability unit IIe-2; Sandy Savannah range site; pasture and hayland suitability group 8A; windbreaks tree suitability group 8; no woodland suitability group.

42—Stephenville fine sandy loam, 3 to 5 percent slopes. This is a gently sloping soil. It has a profile similar to the one described as representative for the series.

Included with this soil in mapping are soils that are similar to Stephenville fine sandy loam except that they are underlain by shale or the surface layer is mixed with the subsoil. These similar soils make up about 3 percent of each mapped area. Also included are Weatherford soils, which make up about 15 percent; Windthorst and Darnell soils, each of which makes up 5 percent; Vernon soils, which make up 4 percent; and Konawa soils, which make up 3 percent.

This Stephenville soil is used mostly for tame pasture grasses, native grasses, small grains, or peanuts. It is also suited to grain sorghum and soybeans.

The main concerns of management are the hazard of erosion and the structure and fertility of the soil. Where row crops are grown, terraces and contour farming are needed. Large amounts of residue can be returned to the soil and plant food can be added to help maintain soil structure and fertility and to increase the intake rate of water. Where terraces are not used, a cropping system that includes only soil maintaining crops is needed. Capability unit IIIe-3; Sandy Savannah range site; pasture and hayland suitability group 8A; windbreaks tree suitability group 8; no woodland suitability group.

43—Stephenville-Darnell complex, 5 to 12 percent slopes. These are sloping through strongly sloping soils. Stephenville and Darnell soils are in such an intricate pattern that it is impractical to map each kind of soil separately.

Included with these soils in mapping are soils that are similar to Stephenville soil but are underlain by shale or have gray mottles in the subsoil. These similar soils make up about 10 percent of each mapped area. Also included are soils that are similar to Darnell soil except that they are less than 10 inches or are 20 to 40 inches thick to sandstone. Included Windthorst soils make up about 5 percent of each mapped area, and soils that are similar to Windthorst soils but are 20 to 40 inches thick to shale make up about 10 percent. Also included are Weatherford soils, which make up about 10 percent; Noble, Konawa, and Dougherty soils, each of which makes up 3 percent; Eufaula soils, which make up 1 percent; and Vernon soils, which make up only a trace of the total acreage.

About 30 percent of the acreage is Stephenville soil, and about 20 percent is Darnell soil. The Stephenville soil has a profile similar to the one described as representative for its series. The Darnell soil has the profile described as representative for its series (fig. 8).

Stephenville and Darnell soils are used mostly for tame pasture grasses and native grasses or scrubby hardwood trees with a sparce understory of native grasses.

The main concern of management is keeping the grasses growing vigorously. Capability unit VIe-6; Sandy Savannah range site for Stephenville soils and Shallow Savannah range site for Darnell soils; pasture and hayland suitability group 8A for Stephenville soils and 14A for Darnell soils; windbreaks tree suitability group 8; no woodland suitability group.

Teller Series

The Teller series consists of deep, well drained, gently sloping soils on uplands. These soils formed under a cover of hardwood forest and grass in material weathered from loamy sediment.

In a representative profile the surface layer is 11 inches of reddish brown fine sandy loam. The next layer, to a depth of 18 inches, is reddish brown fine sandy loam. The subsoil to a depth of 60 inches is red sandy clay loam and fine sandy loam.

Teller soils have moderate permeability. Available water capacity is high.

Representative profile of Teller fine sandy loam, 3 to 5 percent slopes, about 1,700 feet north and 50 feet west of the southeast corner of section 19, T. 11 N., R 3 E.:

A1—0 to 11 inches; reddish brown (5YR 4/3) fine sandy loam, dark reddish brown (5YR 3/3) when moist; weak fine granular structure; hard, very friable; medium acid; clear smooth boundary.

B1—11 to 18 inches; reddish brown (5YR 4/3) fine sandy loam, dark reddish brown (5YR 3/3) when moist; weak fine granular structure; hard, very friable; medium acid; gradual smooth boundary.

B2t—18 to 36 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) when moist; weak medium subangular blocky structure; hard, friable; clay films on faces of peds and bridging sand grains; medium acid; gradual smooth boundary.

B3—36 to 60 inches; red (2.5YR 4/8) fine sandy loam, weak coarse subangular blocky structure; hard, very friable; clay films on a few

faces of peds and bridging sand grains; few iron-manganese oxide concretions; medium acid.

The A1 or Ap horizon is reddish brown, grayish brown, or dark brown. It ranges from medium acid through slightly acid. The B1 horizon is reddish brown or brown. It ranges from medium acid through slightly acid. The B2t horizon is red, reddish brown, or yellowish red. It ranges from medium acid through slightly acid. The B3 horizon is red, reddish brown, or yellowish red. It ranges from medium acid through neutral.

44—Teller fine sandy loam, 3 to 5 percent slopes. This soil is gently sloping (fig. 9).

Included with this soil in mapping are soils that are similar to Teller fine sandy loam except that the surface layer is slightly lighter in color. These similar soils make up about 15 percent of each mapped area. Also included are Konawa soils, which make up about 10 percent, and Norge soils, which make up about 5 percent.

This Teller soil is used mostly for tame pasture grasses, small grains, grain sorghum, and peanuts. It is also suited to soybeans and native grasses.

The main concerns of management are the hazard of erosion and the fertility and structure of the soil. Where row crops are grown, terraces and contour farming are needed. Large amounts of crop residue can be returned to the soil and plant food can be added to help maintain organic-matter content, soil fertility, and soil structure and to increase the intake rate of water. Where terraces are not used, a cropping system that includes only soil maintaining crops is needed. Capability unit IIIe-2; Loamy Prairie range site; pasture and hayland suitability group 8A; windbreaks tree suitability group 8; no woodland suitability group.

Tribbey Series

The Tribbey series consists of deep, somewhat poorly drained, nearly level through very gently sloping soils on flood plains. These soils formed under a cover of hardwood forest and grass in material weathered from loamy and sandy sediment.

In a representative profile the surface layer is 10 inches of red fine sandy loam. The underlying material to a depth of 65 inches is red fine sandy loam and very dark grayish brown loam.

Tribbey soils have moderately rapid permeability. Available water capacity is high. These soils have a water table at a depth of 1 1/2 to 3 feet most of the year.

Representative profile of Tribbey fine sandy loam, about 1,400 feet south and 200 feet east of the northwest corner of section 33, T. 10 N., R 2 E.:

A1—0 to 10 inches; red (2.5YR 5/6) fine sandy loam, red (2.5YR 4/6) when moist; weak medium granular structure; slightly hard, very friable; mildly alkaline; clear smooth boundary.

C1—10 to 40 inches; red (2.5YR 5/6) fine sandy loam, red (2.5YR 4/6) when moist; massive; slightly hard, very friable; common thin strata of darker and lighter colored loamy fine sand and fine sand; saturated with water at a depth of 30 inches; moderately alkaline; clear smooth boundary.

C2—40 to 50 inches; red (2.5YR 5/6) fine sandy loam, red (2.5YR 4/6) when moist; massive; hard, very friable; many thin strata of loamy fine sand and fine sand; saturated with water; moderately alkaline; clear smooth boundary.

Ab—50 to 65 inches; very dark grayish brown (10YR 3/2 when moist) loam; common fine distinct red (2.5YR 5/6) and gray (10YR 5/1) mottles; weak fine granular structure; hard, friable; saturated with water; moderately alkaline.

The A1 horizon is red, reddish brown, or yellowish red. It ranges from medium acid through moderately alkaline. The C horizon is red, reddish brown, light reddish brown, or reddish yellow. It is stratified fine sandy loam, loam, loamy fine sand, or loamy very fine sand and ranges from medium acid through moderately alkaline. The Ab horizon, where present, is very dark grayish brown, dark grayish brown, reddish brown, dark brown, brown, dark reddish gray, or reddish gray when moist. It is stratified loam, fine sandy loam, or clay loam and ranges from neutral through moderately alkaline.

45—Tribbey fine sandy loam. This soil is nearly level through very gently sloping. It is subject to frequent flooding.

Included with this soil in mapping are soils that are similar to Tribbey fine sandy loam except that the water table is near the surface or 4 to 5 feet below the surface most of the year. These similar soils make up about 10 percent of each mapped area.

This Tribbey soil is used mostly for tame pasture grasses, native grasses, or hardwood trees.

The main concerns of management are frequent flooding, fertility of the soil, and overgrazing. Capability unit Vw-2; Wetland range site; pasture and hayland suitability group 2B; windbreaks tree suitability group 1; woodland suitability group 3w4.

Vanoss Series

The Vanoss series consists of deep, well drained, nearly level through very gently sloping soils on uplands. These soils formed under a cover of grass in material weathered from loamy sediment.

In a representative profile the surface layer is 7 inches of grayish brown loam. The next layer, to a depth of 11 inches, is grayish brown loam. The next layer, to a depth of 15 inches, is brown loam. The subsoil, to a depth of 50 inches, is dark yellowish brown and yellowish brown clay loam. The underlying material to a depth of 95 inches is pale brown loam.

Vanoss soils have moderate permeability. Available water capacity is high.

Representative profile of Vanoss loam, 0 to 1 percent slopes, about 1,400 feet south and 2,200 feet east of the northwest corner of section 24, T. 10 N., R. 3 E.:

Ap—0 to 7 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak fine granular structure; slightly hard, friable; strongly acid; abrupt smooth boundary.

A12—7 to 11 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; moderate very fine granular structure; slightly hard, friable; strongly acid; clear smooth boundary.

B1—11 to 15 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) when moist; weak medium subangular blocky structure; slightly hard, friable; medium acid; clear smooth boundary.

B21t—15 to 27 inches; dark yellowish brown (10YR 4/4) clay loam, dark yellowish brown (10YR 3/4) when moist; weak medium prismatic breaking to moderate medium subangular blocky structure; very

hard, friable; clay films on faces of peds; medium acid; clear smooth boundary.

B22t—27 to 37 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) when moist; weak coarse subangular blocky structure; very hard, friable; clay films on faces of peds; medium acid; clear smooth boundary.

B3—37 to 50 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) when moist; weak coarse subangular blocky structure; hard, friable; clay films on faces of peds; medium acid; gradual smooth boundary.

C—50 to 95 inches; pale brown (10YR 6/3) loam, many medium faint grayish brown (10YR 5/2), brown (10YR 5/3), and yellowish brown mottles; massive; hard, friable; medium acid.

The A1 or Ap horizon is grayish brown, dark grayish brown, or brown. It ranges from strongly acid through slightly acid. The B1 horizon is brown, dark grayish brown, or dark brown. It is loam, clay loam, or silt loam and ranges from medium acid through slightly acid. The B2t horizon is dark yellowish brown, yellowish brown, or brown. It is clay loam or silty clay loam and ranges from medium acid through slightly acid. The B3 horizon is yellowish brown, strong brown, or brown. It is clay loam, silt loam, or loam and ranges from medium acid through neutral. The C horizon is pale brown, yellowish brown, or strong brown. It is loam, fine sandy loam, or clay loam and ranges from medium acid through neutral.

46—Vanoss loam, 0 to 1 percent slopes. This is a nearly level soil. It has the profile described as representative for the series.

Included with this soil in mapping are soils that are similar to Vanoss loam except that the combined thickness of the surface layer and the next layer is more than 20 inches. These similar soils make up about 10 percent of each mapped area. Also included are Galey and Teller soils, each of which makes up about 3 percent, and Konawa and Norge soils, each of which makes up about 2 percent.

This Vanoss soil is used mostly for small grains, alfalfa hay, peanuts, and grain sorghum. It is also suited to soybeans, tame pasture grasses, and native grasses.

The main concerns of management are the structure and fertility of the soil. Large amounts of residue can be returned to the soil and plant food can be added to help maintain organic matter content and soil structure and fertility and to increase the intake rate of water. Capability unit I-2; Loamy Prairie range site; pasture and hayland suitability group 8A; windbreaks tree suitability group 8; no woodland suitability group.

47—Vanoss loam, 1 to 3 percent slopes. This soil is very gently sloping. It has a profile similar to the one described as representative for the series.

Included with this soil in mapping are soils that are similar to Vanoss loam except that the combined thickness of the surface layer and the next layer is more than 20 inches. These similar soils make up about 5 percent of each mapped area. Also included are Teller soils, which make up about 20 percent; Galey and Konawa soils, each of which makes up 2 percent; and Norge soils, which make up 1 percent.

This Vanoss soil is used mostly for small grains, grain sorghum, peanuts, and tame pasture grasses. It is also suited to alfalfa hay, soybeans, and native grasses.

The main concerns of management are the hazard of erosion and the structure and fertility of the soil. Most adapted crops can be grown if this soil is well managed. Returning crop residue to the soil and adding plant food are good management practices. Terraces with protected outlets, contour farming, and minimum tillage are needed where row crops are grown. Capability unit IIe-1; Loamy Prairie rane site; pasture and hayland suitability group 8A; windbreaks tree suitability group 8; no woodland suitability group.

Vernon Series

The Vernon series consists of deep, well drained, gently sloping through strongly sloping soils on uplands. These soils formed under a cover of grass in material weathered from shale or clayey sediment.

In a representative profile the surface layer is 5 inches of reddish brown clay. The subsoil, to a depth of 30 inches, is reddish brown clay. The underlying material to a depth of 60 inches is red clay.

Vernon soils have very slow permeability. Available water capacity is moderate.

Representative profile of Vernon clay, 5 to 12 percent slopes, about 50 feet east and 50 feet north of the southwest corner of section 9, T. 8 N., R. 4 E.:

A1—0 to 5 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) when moist; moderate medium granular structure; extremely hard, very firm; calcareous; moderately alkaline; gradual smooth boundary.

B2—5 to 12 inches; reddish brown (2.5YR 5/4) clay, reddish brown (2.5YR 4/4) when moist; moderate medium and fine blocky structure; extremely hard, very firm; few fine spots of soft calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B3—12 to 30 inches; reddish brown (2.5YR 5/4) clay, reddish brown (2.5YR 4/4) when moist; weak medium and fine blocky structure; extremely hard, very firm; few slickensides; common fine and medium spots of soft calcium carbonates; calcareous; moderately alkaline; gradual smooth boundary.

C—30 to 60 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) when moist; massive; extremely hard, very firm; few slickensides; calcareous; moderately alkaline.

The A1 or Ap horizon is reddish brown or yellowish red. It is clay or clay loam and ranges from mildly alkaline through moderately alkaline. The B2 and B3 horizons are reddish brown, red, or yellowish red. They are clay or silty clay. The C horizon is red, yellowish red, or reddish brown. It is clay, silty clay, or shaly clay.

48—Vernon clay loam, 3 to 5 percent slopes. This soil is gently sloping. It has a profile similar to the one described as representative for the series except that the surface layer is clay loam.

Included with this soil in mapping are Renfrow soils, which make up about 10 percent of each mapped area, and Zaneis soils, which make up about 5 percent.

This Vernon soil is used mostly for native grasses, small grains, and annual hay crops. It is also suited to grain sorghum, soybeans, and tame pasture grasses.

The main concerns of management are the hazard of erosion, slow intake of water, droughtiness, and the structure and fertility of the soil. Returning crop residue to

the soil and using plant food are good management practices. Terraces with protected outlets, contour farming, and minimum tillage are needed where this soil is used for row crops. Where terraces are not used, a cropping system that includes only soil maintaining crops is needed. Capability unit IVe-1; Red Clay Prairie range site; pasture and hayland suitability group 7A; windbreaks tree suitability group 9; no woodland suitability group.

49—Vernon clay, 5 to 12 percent slopes. This soil is sloping through strongly sloping. It has the profile described as representative for the series.

Included with this soil in mapping are soils that are similar to Vernon clay except that the surface layer and the upper part of the subsoil are slightly darker. These similar soils make up about 15 percent of each mapped area. Also included are Zaneis soils, which make up about 10 percent; Renfrow soils, which make up 7 percent; Darnell soils and soils that are similar to Darnell soils but are less than 10 inches thick over sandstone, each of which makes up about 5 percent; and soils that are similar to Teller soils but are 20 to 40 inches thick over shale or claybeds, which make up 3 percent.

This Vernon soil is used mostly for native grasses. The main concern of management is keeping the grasses growing vigorously. Capability unit VIe-2; Red Clay Prairie range site; pasture and hayland suitability group 7A; windbreaks tree suitability group 9; no woodland suitability group.

50—Vernon-Port complex. These are nearly level through strongly sloping soils. Vernon and Port soils are in such an intricate pattern that it is impractical to map each kind of soil separately. Port soils are frequently flooded.

Included with these soils in mapping are Aydelotte soils and soils that are similar to Aydelotte soils but are less than 60 inches thick over shale, each of which makes up about 10 percent of each mapped area; Zaneis soils and soils that are similar to Zaneis soils but are 20 to 40 inches thick over rock, which make up, respectively, 7 and 5 percent; Renfrow soils, which make up 5 percent; Chickasha soils and soils that are similar to Chickasha soils but are 20 to 40 inches thick over rock, each of which makes up 5 percent; Yahola and Pulaski soils, each of which makes up 5 percent; soils that are similar to Port soils but are lighter in color, which make up 5 percent; and Seminole soils, which make up 3 percent.

About 20 percent of the acreage is Vernon soils, and 15 percent is Port soils. The Vernon soils have a profile similar to the one described as representative for their series, but the surface layer is clay loam in places. The Port soils have a profile similar to the one described as representative for the series, but the surface layer is fine sandy loam and silt loam in places. These soils are used mostly for range.

The main concern of management is to keep the grasses growing vigorously. Capability unit VIe-8; Red Clay Prairie range site for Vernon soils and Loamy Bottomland range site for Port soils; pasture and hayland suitability goup 7A for Vernon soils and 2A for Port soils; windbreaks tree suitability group 9; woodland suitability group for Port soils 3o4, no woodland suitability group for Vernon soils.

Weatherford Series

The Weatherford series consists of deep, well drained, very gently sloping through sloping soils on uplands. These soils are formed under a cover of hardwood forest and grass in material weathered from sandstone.

In a representative profile the surface layer is 5 inches of brown fine sandy loam. The subsurface layer, to a depth of 12 inches, is brown fine sandy loam. The subsoil, to a depth of 52 inches, is red and light red sandy clay loam. It is underlain by dark reddish brown sandstone to a depth of 60 inches.

Weatherford soils have moderate permeability. Available water capacity is high.

Representative profile of Weatherford fine sandy loam, 1 to 3 percent slopes, about 100 feet east and 135 feet north of the southwest corner of section 29, T. 10 N., R. 2 E.:

A1—0 to 5 inches; brown (7.5YR 5/2) fine sandy loam, dark brown (7.5YR 3/2) when moist; weak fine granular structure; slightly hard, very friable; slightly acid; clear smooth boundary.

A2—5 to 12 inches; brown (7.5YR 5/3) fine sandy loam, brown (7.5YR 4/3) when moist; weak fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

B21t—12 to 18 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) when moist; moderate medium subangular blocky structure; very hard, friable; clay films bridging sand grains and on faces of peds; medium acid; gradual smooth boundary.

B22t—18 to 30 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) when moist; moderate medium and fine subangular blocky structure; very hard, friable; clay films bridging sand grains and on faces of peds; medium acid; gradual smooth boundary.

B23t—30 to 52 inches; light red, (2.5YR 6/6) sandy clay loam, red (2.5YR 5/6) when moist; common bodies of red (2.5YR 5/6) when moist; weak coarse subangular blocky structure; very hard, friable; clay bridging sand grains and on faces of peds; medium acid; clear smooth boundary.

C—52 to 60 inches; dark reddish brown (2.5YR 3/4) sandstone; hard and massive; soft and friable when moist.

The A1 or Ap horizon is brown, light brownish gray, grayish brown, dark grayish brown, or light brown. it ranges from slightly acid through neutral. The A2 horizon is brown, pale brown, very pale brown, yellowish brown, light brown, light yellowish brown, light brownish gray, reddish yellow, or pink. It ranges from slightly acid through neutral. The B21t and B22t horizons are red, yellowish red, light red, reddish yellow, or reddish brown. They range from medium acid through slightly acid. The B23t horizon is light red, red, yellowish red, or reddish yellow. It is sandy clay loam or fine sandy loam and ranges from medium acid through slightly acid. Depth to rippable sandstone is 40 to 60 inches.

51—Weatherford fine sandy loam, 1 to 3 percent slopes. This soil is very gently sloping. It has the profile described as representative of the series.

Included with this soil in mapping are Stephenville soils, which make up 20 percent of each mapped area; Konawa soils, which make up 5 percent; Windthorst soils, which make up 4 percent; and Vernon soils, which make

up 1 percent. Also included are soils that are similar to Weatherford soils but have shale at a depth of 40 to 60 inches or gray mottles in the lower part of the subsoil. These similar soils make up about 5 percent of each mapped area.

This Weatherford soil is used mostly for pasture grasses, native grasses, small grains, grain sorghums, and peanuts. It is also suited to soybeans.

The main concerns of management are the hazard of erosion and the structure and fertility of the soil. Most crops that produce large amounts of residue can be grown continuously if the soil is well managed, if crop residue is returned to the soil, and if plant food is added. Terraces with protected outlets, contour farming, and minimum tillage are needed where row crops are grown. Capability unit IIe-2; Sandy Savannah range site; pasture and hayland suitability group 8A; windbreaks tree suitability group 8; no woodland suitability group.

52—Weatherford fine sandy loam, 3 to 5 percent slopes. This is a gently sloping soil. It has a profile similar to the one described as representative for the series.

Included with this soil in mapping are Stephenville soils, which make up about 30 percent of each mapped area; Konawa and Windthorst soils, each of which makes up 5 percent; Chickasha soils, which make up 3 percent; and Vernon and Darnell soils, each of which makes up 1 percent.

This Weatherford soil is used mostly for tame pasture grasses, native grasses, small grains, grain sorghum, and peanuts. It is also suited to soybeans.

The main concerns of management are the hazard of erosion and the structure and fertility of the soil. Where row crops are grown, terraces and contour farming are needed. Large amounts of residue can be returned to the soil and plant food can be added to help maintain soil structure and fertility and to increase the intake rate of water. Where terraces are not used, a cropping system that includes only soil maintaining crops is needed. Capability unit IIIe-3; Sandy Savannah range site; pasture and hayland suitability group 8A; windbreaks tree suitability group 8; no woodland suitability group.

53—Weatherford and Stephenville soils, 3 to 8 percent slopes, severely eroded. These are gently sloping through sloping soils. They have profiles similar to the ones described as representative for their respective series except that the surface layer is thinner and is mixed with the subsoil in places. Weatherford and Stephenville soils occur without regularity of pattern.

Included with these soils in mapping are soils that are similar to Weatherford and Stephenville soils except that their subsoil is exposed at the surface in gullies. These soils make up about 35 percent of each mapped area. Gullies are 50 to 200 feet apart, 10 to 100 feet wide, and less than 8 feet deep in most places. Also included are Darnell, Windthorst, Konawa, and Vernon soils or similar soils that are severely eroded in most places. These soils make up about 25 percent of each mapped area.

Weatherford and Stephenville soils are used mostly for tame pasture grasses and native grasses.

The main concerns of management are keeping grasses growing vigorously and controlling erosion. Capability unit VIe-5; Eroded Sandy Savannah range site; pasture and hayland suitability group 8F; windbreaks tree suitability group 8; no woodland suitability group.

Windthorst Series

The Windthorst series consists of deep, moderately well drained, very gently sloping through gently sloping soils on uplands. These soils are formed under a cover of hardwood forest and grass in material weathered from shale.

In a representative profile the surface layer is 3 inches of grayish brown fine sandy loam. The subsurface layer, to a depth of 10 inches, is pale brown fine sandy loam. The subsoil, to a depth of 45 inches, is red clay. It is underlain by thinly bedded red shale and sandy shale to a depth of 60 inches or more.

Windthorst soils have moderately slow permeability. Available water capacity is high.

Representative profile of Windthorst fine sandy loam, 1 to 5 percent slopes, about 1,100 feet north and 800 feet west of the southeast corner of section 18, T. 7 N., R 2 E.:

A1—0 to 3 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak fine granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

A2—3 to 10 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) when moist; massive; slightly hard, very friable; medium acid; abrupt smooth boundary.

B2t—10 to 30 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) when moist; moderate medium and fine blocky structure; very hard, firm; clay films on faces of peds; medium acid; clear smooth boundary.

B3—30 to 45 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) when moist; weak medium and fine blocky structure; very hard, very firm; clay films on faces of peds; mildly alkaline; gradual smooth boundary.

C—45 to 60 inches; red (2.5YR 5/6) slightly weathered thinly bedded shale and sandy shale.

The A1 or Ap horizon is brown or grayish brown. It ranges from medium acid through neutral. The A2 horizon is light brown, pink, or pale brown. It ranges from medium acid through slightly acid. Where this soil has been cultivated, all of the A2 horizon may be mixed with the Ap horizon. The B2t horizon is red or yellowish red. It is clay or sandy clay and ranges from medium acid through slightly acid. The B3 horizon is clay loam, clay, or sandy clay and ranges from medium acid through moderately alkaline. Depth to rippable shale is 40 to 60 inches.

54—Windthorst fine sandy loam, 1 to 5 percent slopes. This soil is very gently sloping through gently sloping.

Included with this soil in mapping are soils that are similar to Windthorst fine sandy loam except that the subsoil is strongly acid or the depth to shale is 20 to 35 inches. Also included are other soils that are similar to Windthorst fine sandy loam except that the surface layer is reddish brown or yellowish red. These similar soils make up, respectively, about 25 and 10 percent of each mapped area. Also included are Stephenville soils, which make up 5 percent; Vernon soils, which make up 3 percent; and Renfrow soils, which make up 2 percent.

This Windthorst soil is used mostly for tame pasture grasses, native grasses, and small grains. It is also suited to grain sorghums, soybeans, and peanuts.

The main concerns of management are the hazard of erosion and the structure and fertility of the soil. Where row crops are grown, terraces and contour farming are needed. Large amounts of residue can be returned to the soil and plant food can be added to help maintain soil structure and fertility and to increase the intake rate of water. Where terraces are not used, a cropping system that includes only soil maintaining crops is needed. Capability unit IIIe-3; Sandy Savannah range site; pasture and hayland suitability group 8A; windbreaks tree suitability group 6; no woodland suitability group.

Yahola Series

The Yahola series consists of deep, well drained, nearly level through very gently sloping soils on flood plains. These soils are formed under a cover of hardwood forest and grass in material weathered from loamy sediment.

In a representative profile, the surface layer is 12 inches of reddish brown fine sandy loam. The underlying material to a depth of 60 inches is reddish brown fine sandy loam stratified with thin layers of more sandy and clayey sediment.

Yahola soils have moderately rapid permeability. Available water capacity is high.

Representative profile of Yahola fine sandy loam, about 400 feet north and 200 feet west of the southeast corner of section 28, T. 8 N., R. 4 E.:

A1—0 to 12 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) when moist; weak fine granular structure; slightly hard, very friable; calcareous; moderately alkaline; clear smooth boundary.

C1—12 to 60 inches; reddish brown (5YR 5/4) fine sandy loam, stratified with thin layers of more sandy and clayey materials; reddish brown (5YR 4/4) when moist; massive; slightly hard, very friable; calcareous; moderately alkaline.

The A1 or Ap horizon is reddish brown, light reddish brown, yellowish red, or brown. The C horizon is reddish brown or yellowish red. It has thin strata of loamy fine sand, very fine sandy loam, or loam. In some areas dark colored buried horizons are below a depth of 40 inches.

55—Yahola fine sandy loam. This soil is nearly level through very gently sloping. It is subject to occasional flooding.

Included with this soil in mapping are Gaddy soils, which make up about 15 percent of each mapped area, and Pulaski and Port soils, each of which makes up 10 percent. Also included are soils that are similar to Yahola soils but have a loam or silty clay loam surface layer that is darker colored and noncalcareous to a depth of 10 to 20 inches.

This Yahola fine sandy loam is used mostly for alfalfa hay, small grains, and pasture grasses. It is also suited to grain sorghums, peanuts, soybeans, native grasses, and hardwood trees.

The main concerns of management are occasional flooding and the structure and fertility of the soil. Most crops grown on this soil produce large amounts of residue and can be grown continuously where crop residue is returned to the soil and plant food is added. Capability unit IIw-2; Loamy Bottomland range site; pasture and hayland suitability group 2A; windbreaks tree suitability group 3; woodland suitability group 3o4.

Zaneis Series

The Zaneis series consists of deep, well drained, very gently sloping through sloping soils on uplands. These soils formed under a cover of grass in material weathered from sandy shale or sandstone.

In a representative profile the surface layer is 9 inches of dark brown loam. The next layer, to a depth of 14 inches, is reddish brown loam. The subsoil, to a depth of 52 inches, is yellowish red clay loam. It is underlain by slightly weathered sandstone to a depth of 60 inches or more.

Zaneis soils have moderately slow permeability. Available water capacity is high.

Representative profile of Zaneis loam, 3 to 5 percent slopes, about 1,450 feet south and 125 feet west of the northeast corner of section 4, T. 11 N., R. 4 E.:

A1—0 to 9 inches; dark brown (7.5YR 4/2) loam, very dark brown (7.5YR 2/2) when moist; moderate medium granular structure; slightly hard, friable; slightly acid; gradual smooth boundary.

B1—9 to 14 inches; reddish brown (5YR 4/3) loam, dark reddish brown (5YR 3/3) when moist; moderate medium subangular blocky breaking to moderate medium granular structure; hard, friable; patchy clay films on faces of peds in lower part, slightly acid; gradual smooth boundary.

B21t—14 to 24 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) when moist; moderate medium subangular blocky structure; very hard, friable; clay films on faces of peds; slightly acid; gradual smooth boundary.

B22t—24 to 52 inches; yellowish red (5YR 5/6) clay loam, bodies and mottles of reddish yellow (5YR 6/6), reddish brown (5YR 5/3, 5/4), and red (2.5YR 5/6), yellowish red (5YR 4/6) when moist; weak medium subangular blocky structure; very hard, firm; clay films on faces of peds; slightly acid; clear smooth boundary.

C—52 to 60 inches; slightly weathered sandstone.

The A1 or Ap horizon is dark brown, grayish brown, brown, reddish brown, or reddish gray. It is loam or fine sandy loam and ranges from medium acid through slightly acid, but in some limed areas it is neutral. The B1 horizon is reddish brown or brown. It is loam or clay loam and ranges from medium acid through neutral. The B2t horizon is yellowish red, red, or reddish brown. It is clay loam or sandy clay loam and ranges from medium acid through neutral. The B3 horizon, where present, is yellowish red, red or light red. It is clay loam, sandy clay loam, or fine sandy loam and ranges from slightly acid through mildly alkaline. The C horizon is sandstone or sandy shale. Depth to rippable sandstone or shale is 40 to 60 inches.

56—Zaneis loam, 1 to 3 percent slopes. This is a very gently sloping soil. It has a profile similar to the one described as representative for the series.

Included with this soil in mapping are soils that are similar to Zaneis loam but have sandstone at a depth of 30 to 40 inches. These similar soils make up about 30 per-

cent of each mapped area. Also included are Renfrow soils, which make up 5 percent; soils that are similar to Zaneis loam but have clay at a depth of 40 to 60 inches, which also make up 5 percent; and slickspots, which make up 2 percent.

This Zaneis soil is used mostly for pasture grasses, native grasses, small grains, grain sorghum, and annual hay crops. It is also suited to alfalfa hay, soybeans, and peanuts (fig. 10).

The main concerns of management are the hazard of erosion and the structure and fertility of the soil. Most adapted crops can be grown if this soil is well managed. Returning crop residue to the soil and using plant food are good management practices. Terraces with protected outlets, contour farming, and minimum tillage are needed where row crops are grown. Capability unit IIe-1; Loamy Prairie range site; pasture and hayland suitability group 8A; windbreaks tree suitability group 8; no woodland suitability group.

57—Zaneis loam, 3 to 5 percent slopes. This is a gently sloping soil. It has the profile described as representative for the series.

Included with this soil in mapping are soils that are similar to Zaneis loam but have sandstone at a depth of 27 to 40 inches. These similar soils make up about 15 percent of each mapped area. Also included are Renfrow soils, which make up 10 percent; soils that are similar to Zanies loam but have clay at a depth of 40 to 60 inches or sandstone at a depth of more than 60 inches, which make up 3 percent; Stephenville soils, which make up 2 percent; and slickspots, which also make up 2 percent.

This Zaneis soil is used mostly for pasture grasses, native grasses, small grains, grain sorghum, and annual hay crops. It is also suited to soybeans and peanuts.

The main concerns of management are the hazard of erosion and the fertility and structure of the soil. Where row crops are grown, terraces with protected outlets and contour farming are needed. Large amounts of crop residue can be returned to the soil and plant food can be added to help maintain organic matter content and soil structure and to increase the rate of water intake. Where terraces are not used, a cropping system that includes only soil maintaining crops is needed. Capability unit IIIe-2; Loamy Prairie range site; pasture and hayland suitability group 8A; windbreaks tree suitability group 8; no woodland suitability group.

Planning the Use and Management of the Soils

The soil survey is a detailed analysis and evaluation of the most basic resource of the survey area—the soil. It may be used to fit the use of the land, including urbanization, to the limitations and potentials of the natural resources and the environment and to help avoid soil-related failures in uses of the land.

During a soil survey soil scientists, conservationists, engineers, and others keep extensive notes, not only about the nature of the soils but also about unique aspects of behavior of these soils in the field and at construction sites. These notes include observations of erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic systems, and other factors relating the kinds of soil and their productivity, potentials, and limitations under various uses and management. In this way field experience incorporated with measured data on soil properties and performance is used as a basis for predicting soil behavior.

Information in this section is useful in applying basic facts about the soils to plans and decisions for use and management of soils for crops and pasture, range, woodland, and many nonfarm uses. The nonfarm uses include building sites, highways and other transportation systems, sanitary facilities, parks and other recreational developments, and wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in homes and other structures, because of unfavorable soil properties, can be avoided. A site can be selected where the soil properties are favorable, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area, and on the environment. Both of these factors are closely related to the nature of the soil. Plans can be made to maintain or create a land use pattern in harmony with the natural soil.

Contractors can find information useful in locating sources of sand and gravel, road fill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, trees and shrubs, and most other uses of land are influenced by the nature of the soil.

Crops and Pasture

TED B. LEHNMAN, conservation agronomist, Soil Conservation Service, helped prepare this section.

Cultivated soils in this county need management that will conserve moisture, control erosion, maintain fertility, supply organic matter, and provide good tilth. Some of the management practices commonly required in the county are discussed in the following paragraphs. For suggested combinations of practices for specific soils, see the section "Descriptions of the Soils." Most good management practices accomplish more than one purpose and can be used on nearly all the cropland in the county.

Where soils are to be cropped, they must be worked to prepare a seedbed, to control weeds, and to provide a place for the growth of plant roots. Excessive tillage breaks down the soil structure and speeds the decomposition of organic matter. The soils then tend to puddle and crust at the surface, take in less water and air, and store less moisture for plant growth.

Minimum tillage is accomplished by using a long-term cropping system with perennial grasses or deep-rooted legumes, using herbicides instead of cultivation for weed control, and reducing the number of operations in preparing the seedbed, planting, and cultivating.

Leaving crop residue on the surface during winter and spring, or working it partly into the surface, is needed to protect soils from erosion. Organic matter, or humus, supplied in crop residue improves the tilth of the surface layer. The improved tilth then increases infiltration and storage of water, reduces the hazard of erosion, and helps prevent crusting.

The main objectives in using soil-improving crops are maintaining or improving the physical condition and the productivity of the soil and controlling erosion, weeds, insects, and diseases. A cropping system that improves the soil includes crops that produce large amounts of residue.

Crop residue and weeds are the largest sources of organic material for maintenance of soil fertility and soil structure. This residue needs the addition of nitrogen fertilizer to prevent a shortage of nitrogen for the succeeding crop.

Crops that do not help control erosion, improve soil structure, or build up the organic-matter content are soil-depleting crops. Such crops are used sparingly in a good cropping system. Clean-tilled crops, if the forage is removed for silage or cut low for bundle feed or hay, and soybeans cut for hay are soil-depleting crops if most of the top growth is removed each year.

Small grains and vetch are suitable cool-season cover crops. They are generally sown after harvest of such plants as peanuts and soybeans, and they improve the soil and protect it from erosion.

Grassed waterways consist principally of broad, flat-bottomed channels seeded or sodded with perennial plants, commonly bermudagrass or native grasses. Grassed waterways are needed for terrace outlets to provide safe disposal of excess water. They are also used with diversion terraces and in natural drainageways.

Much of the acreage in Pottawatomie County is in pasture. Pasture plants are grown on Class I through Class VII soils. The trend is to convert cropland to pasture. Because of high land values, extensive acreages of wooded class IV and VI soils also are being cleared and planted to tame pasture plants.

The principal grasses are improved bermudagrass and lovegrass. Bermudagrass is usually overseeded in a mixture with legumes such as annual lespedeza, serica lespedeza, and yellow hop clover. A bermudagrass-legume mixture is the main summer pasture vegetation. Improved varieties of bermudagrass under good management produce more forage than common bermudagrass. Bermudagrass is well suited to most Class I through VII soils. Winter rye and vetch, when overseeded on bermudagrass, provide grazing late in fall and early in spring. Sudan and sorghum hybrids are used for summer temporary pasture where perennial forages are in short supply. Fall-sown small grains such as winter wheat or rye are sometimes used for fall, winter, and spring grazing as a supplement to the native and perennial tame pasture plants.

Lovegrass is better suited to the sandy soils, such as Eufaula and Dougherty soils, but it grows as well as bermudagrass on loamy soils. It provides summer grazing, but unless it is managed well, it becomes unpalatable.

Other common tame pasture grasses are King Ranch bluestem and tall fescue. King Ranch bluestem is adapted to the more clayey soils such as Vernon or Aydelotte soils. It is more difficult than bermudagrass to establish, but it is more drought resistant. Tall fescue is suited to the deep soils on bottom lands and does best on the wetter ones, such as Latanier, Gracemont, or Tribbey soils. It provides grazing early in spring and late in fall.

Proper grazing helps to lengthen the life of most pastures. Fescue pasture needs to be rested. This permits the plants to regain vigor and allows the root system to produce needed forage.

Brush control is essential, especially on soils on which trees grow. Applying moderate amounts of plant foods that contain the proper elements provides for more vigorous plants and more palatable forage. This helps to increase production and lengthen the lifespan of the pasture. Some legumes, such as Ladino clover, require more phosphate and lime than others, such as yellow hop clover and lespedeza. Commonly, where grasses are grown without legumes, more nitrogen is needed.

Pasture and hayland suitability groups provide help to farmers when selecting suitable forage plants for livestock. The soils of each group support similar pasture plants and require similar treatment and management. Forage production is essentially the same for all soils in each group when management and treatment are the same. Soils that formed under woodland require brush control. If brush is not controlled, tress will grow back and pasture yields will be reduced.

Yields of pasture and hayland are given in table 4. Grazing data are estimated in terms of animal-unit-months.

Yields per acre

The per acre average yields that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in table 5 because of seasonal variations in rainfall and other climatic factors. Absence of a yield estimate indicates that the crop is not suited to or not commonly grown on the soil.

The predicted yields are based mainly on the experience and records of farmers, conservationists, and Extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The latest soil and crop management practices used by many farmers in the county are assumed in predicting the yields. Pasture yields are predicted for one grass variety suited to the soil. A few farmers may be using more advanced practices and are obtaining average yields higher than those shown in table 5.

The management needed to achieve the indicated yields of the various crops depends upon the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

The predicted yields reflect the relative productive capacity of the soils for each of the principal crops. Yields are likely to increase in the future as new production technology is developed. The relative productivity of a given soil compared to other soils, however, is not likely to change.

Crops and pasture plants other than those shown in tables 4 and 5 are grown in the survey area, but because their acreage is small, predicted yields for these crops are not included. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the productivity and management concerns of the soils for these crops.

Capability grouping

Some readers, particularly those who farm on a large scale, may find it practical to use and manage alike some of the different kinds of soil on their farm. These readers can make good use of the capability classification system, a grouping that shows, in a general way, the suitability of soils for most kinds of farming.

The grouping is based on limitations of soils when used for field crops, the risk of damage when they are farmed, and the way the soils respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations for range, for forest trees, or for engineering.

In the capability system, all kinds of soil are grouped at three levels: the class, the subclass, and the unit.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. In class I are soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, so shallow, or otherwise so limited that they do not produce worthwhile yields of crops, forage, or wood products.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly beause it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry. There is no subclass *c* in Pottawatomie County.

In class I there are no subclasses because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c* because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-2 or IIIe-4. Thus, in one symbol, the Roman numeral designates the capability class or degree of limitation; the small letter indicates the subclass or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

The seven classes in the capability system and subclasses and units in Pottawatomie County are described in the list that follows. The capability unit designation for each soil in the county can be found following the description of each mapping unit in the section "Descriptions of the Soils."

Class I. Soils having few limitations that restrict their use.

(No Subclass)

Unit I-1. Deep, nearly level, well drained silt loam soils; on flood plains.

Unit I-2. Deep, nearly level, well drained loam soils; on uplands.

Class II. Soils having moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Subclass IIe. Soils subject to moderate erosion if not protected.

Unit IIe-1. Deep, nearly level through very gently sloping, moderately well drained and well drained loam soils; on uplands.

Unit IIe-2. Deep and moderately deep, nearly level through very gently sloping, moderately well drained and well drained fine sandy loam soils; on uplands.

Subclass IIw. Soils having moderate limitations because of seasonal overflow or surface wetness.

Unit IIw-1. Deep, nearly level, moderately well drained and well drained loam and silty clay loam soils; on flood plains.

Unit IIw-2. Deep, nearly level through very gently sloping, well drained fine sandy loam soils; on flood plains.

Subclass IIs. Soils having moderate limitations because of very slow permeability.

Unit IIs-1. Deep, nearly level, well drained silt loam soils; on uplands.

Class III. Soils having severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Subclass IIIe. Soils subject to severe erosion if they are cultivated and not protected.

Unit IIIe-1. Deep, very gently sloping, well drained silt loam soils; on uplands.

Unit IIIe-2. Deep, very gently sloping through gently sloping, moderately well drained and well drained loam and fine sandy loam soils; on uplands.

Unit IIIe-3. Deep and moderately deep, very gently sloping through gently sloping, moderately well drained and well drained fine sandy loam soils; on uplands.

Unit IIIe-4. Deep, nearly level through very gently sloping, well drained loamy fine sand soils; on uplands.

Subclass IIIw. Soils having severe limitations for cultivation because of excess water.

Unit IIIw-1. Deep, nearly level, moderately well drained and somewhat poorly drained silty clay loam, silty clay, and clay loam soils; on flood plains.

Unit IIIw-2. Deep, nearly level, poorly drained silt loam soils; on uplands.

Subclass IIIs. Soils having severe limitations because of soil features.

Unit IIIs-1. Deep, nearly level through very gently sloping, somewhat excessively drained loamy fine sand soils; on flood plains.

Class IV. Soils having very severe limitations that reduce the choice of plants or that require very careful management, or both.

Subclass IVe. Soils subject to very severe erosion if they are cultivated and not protected.

Unit IVe-1. Deep, gently sloping, well drained clay loam soils; on uplands.

Unit IVe-2. Deep, very gently sloping through gently sloping, well drained loam and silt loam soils; on uplands.

Unit IVe-3. Deep, gently sloping through sloping, well drained fine sandy loam soils; on uplands.

Unit IVe-4. Deep, gently sloping through sloping, well drained loamy fine sand soils; on uplands.

Subclass IVs. Soils having very severe limitations because of soil features.

Unit IVs-1. Deep, nearly level through very gently sloping, somewhat excessively drained loamy fine sand soils; on flood plains.

Unit IVs-2. Deep, nearly level through very gently sloping, somewhat excessively drained fine sand soils; on uplands.

Class V. Soils that are subject to little or no erosion but that have other limitations that limit their use largely to pasture, range, woodland, or wildlife.

Subclass Vw. Soils too wet for cultivation or subject to flooding.

Unit Vw-1. Deep, nearly level through very gently sloping, well drained loam, fine sandy loam, and silt loam soils; on flood plains.

Unit Vw-2. Deep, nearly level through very gently sloping, somewhat poorly drained fine sandy loam and fine sand soils; on flood plains.

Class VI. Soils having severe limitations that make them generally unsuited to cultivation and that limit their use largely to pasture, range, woodland, or wildlife.

Subclass VIe. Soils severely limited, chiefly by risk of erosion, unless protective cover is maintained.

Unit VIe-1. Deep, gently sloping through sloping, well drained, severely eroded clay loam soils; on uplands.

Unit VIe-2. Deep, sloping through strongly sloping, well drained clay soils; on uplands.

Unit VIe-3. Deep, strongly sloping through moderately steep, well drained, very fine sandy loam and fine sandy loam soils; on flood plains.

Unit VIe-4. Deep, very gently sloping through sloping, well drained, severely eroded loam and fine sandy loam soils; on uplands.

Unit VIe-5. Deep and moderately deep, gently sloping through sloping, well drained, severely eroded fine sandy loam soils; on uplands.

Unit VIe-6. Moderately deep and shallow, sloping through strongly sloping, well drained fine sandy loam soils; on uplands.

Unit VIe-7. Deep, gently sloping through strongly sloping, moderately well drained gravelly sandy loam soils; on uplands.

Unit VIe-8. Deep, nearly level thrugh strongly sloping, well drained clay, clay loam, loam, silt loam, and fine sandy loam soils; on uplands and flood plains.

Unit VIe-9. Deep, gently sloping through strongly sloping, somewhat excessively drained fine sand soils; on uplands.

Class VII. Soils having very severe limitations that make them unsuited to cultivation and that restrict their use largely to range, woodland, or wildlife.

Subclass VIIe. Soils very severely limited, chiefly by risk of erosion, unless protective cover is maintained.

Unit VIIe-1. Borrow pits with subsoil and underlying material exposed at the surface; on uplands.

Unit VIIe-2. Gravel pits with subsoil and underlying material exposed at the surface; on uplands.

Subclass VIIw. Soils very severely limited, chiefly by ponded water on the surface.

Unit VIIw-1. Deep, nearly level, poorly drained clay soils; on flood plains.

Class VIII. Soils and landforms having limitations that preclude their use for commercial plant production and that restrict their use to recreation, wildlife, or water supply, or to esthetic purposes. (None in Pottawatomie County.)

Range

ERNEST C. SNOOK, range conservationist, Soil Conservation Service, helped prepare this section.

In this part of the soil survey is information about use of the soils for range. The grouping of soils into range sites is described, and management of the soils in each range site is discussed.

Range is land on which the natural plant community is composed mainly of grasses, grasslike plants, forbs, and shrubs that are valuable for grazing and that are abundant enough to justify use of grazing by domestic animals.

Range occupies about two-thirds of the county. Approximately half of the area is open prairie, and the other half is savannah. The savannah is covered with a mixture of trees and an understory of grasses and forbs.

Most areas used for range are in small livestock farms, but a few large ranches are in the area. The range is usually used in conjunction with tame pastures and small grains, but some is grazed all year long.

The raising of beef cattle is the main agricultural enterprise in the county.

Range sites and condition classes

Different kinds of soil vary in their capacity to produce grass and other plants for grazing. Soils that produce about the same kinds and amounts of forage, if the range is in similar condition, make up a range site.

Range sites are kinds of range that differ in their capacity to produce vegetation. The soils of any one range site produce about the same kind of climax vegetation. Climax vegetation is the stabilized plant community; it reproduces itself and does not change so long as the enivironment remains unchanged. Throughout the prairie and the plains, the climax vegetation consists of the plants that were growing there when the region was first settled. If cultivated crops are not grown, the most productive combination of forage plants on a range site is generally the climax vegetation.

Decreasers are plants in the climax vegetation that tend to decrease in relative amount under close grazing. They generally are the tallest and most productive perennial grasses and forbs and the most palatable to livestock.

Increasers are plants in the climax vegetation that increase in relative amount as the more desirable decreaser plants are reduced by close grazing. They are commonly shorter than decreasers and are generally less palatable to livestock.

Invaders are plants that cannot compete with plants in the climax plant community for moisture, nutrients, and light. Invaders come in and grow with increasers after the climax vegetation has been reduced by grazing. Many invaders are annual weeds, and some are shrubs that have some grazing value, but others have little value for grazing.

Four range condition classes are used to indicate the degree of departure from the potential, or climax, vegetation brought about by grazing or other uses. The classes show the present condition of the native vegetation on a range site in relation to the native vegetation that could grow there.

A range is in excellent condition if 76 to 100 percent of the vegetation is of the same kind as that in the climax stand. It is in good condition if the percentage is 51 to 75; in fair condition if the percentage is 26 to 50; and in poor condition if the percentage is less than 25.

Range condition is judged according to standards that apply to the particular range site. It expresses the present kind and amount of vegetation in relation to the climax plant community for that site.

Potential forage production depends on the range site. Current forage production depends on the range condition and the moisture available to plants during their growing season.

A primary objective of good range management is to keep range in excellent or good condition. If this is done, water is conserved, yields are improved, and the soils are protected. Important changes in the kind of cover on a range site, however, can go unrecognized. These changes take place gradually and can be misinterpreted or overlooked. Growth encouraged by heavy rainfall may lead to the conclusion that the range is in good condition, when actually the cover is weedy and the long-term trend is toward lower production. On the other hand, some range that has been closely grazed for short periods, under the supervision of a careful manager, may have a degraded appearance that temporarily conceals its quality and ability to recover.

Descriptions of range sites

In the following paragraphs, the range sites of Pottawatomie county are described, and the climax plants and principal invaders on the sites are named. Also given

is an estimate of the potential annual yield of air-dry herbage for each site when it is in excellent condition (see table 6).

Table 6 shows, for each kind of soil, the name of the range site, the potential annual production of herbage in favorable, normal, and unfavorable years, and the names of major plant species and the percentage of each in the composition of the potential plant community.

A range site supports a distinctive potential plant community, or combination of plants, that can grow on a site that has not undergone major disturbance. Soils that produce the same kind, amount, and proportion of range plants are grouped into range sites. Range sites can be interpreted directly from the soil map where the relationships between soils and vegetation have been correlated. Properties that determine the capacity of the soil to supply moisture and plant nutrients have the greatest influence on range plants and their productivity. Soil reaction, salt content, and a seasonal high water table are also important.

Potential production refers to the amount of herbage that can be expected to grow on well-managed range that is supporting the potential plant community. It is expressed in pounds per acre of air-dry herbage for favorable, normal, and unfavorable years. A favorable year is one in which the amount and distribution of precipitation and the temperatures result in growing conditions substantially better than average; a normal year is one in which these conditions are about average for the area; an unfavorable year is one in which growing conditions are well below average, generally because of low available soil moisture.

Dry weight refers to the total air-dry herbage produced per acre each year by the potential plant community. All herbage, both that which is highly palatable and that which is unpalatable to livestock, is included. Some of the herbage also may be grazed extensively by wildlife, and some of it may not. Plant species that have special value for livestock forage are mentioned in the description of each range site.

Common names are listed for the grasses, forbs, and shrubs that make up most of the potential plant community on each soil. Under the heading "Composition" in table 5, the proportion of each species is presented as the percentage, in dry-weight, of the total annual production of herbaceous and woody plants. The amount that can be used as forage depends on the kinds of grazing animals and on the season when the forage is grazed. Not all of the herbage produced is normally used.

Range management requires, in addition to knowledge of the kind of soil and the potential plant community, an evaluation of the present condition of the range vegetation in relation to its potential production. Range condition is a comparison of the present plant community with the potential plant community on a particular kind of soil and range site. The more nearly alike the present kinds and amounts of plants and the potential plant community, the better the range condition. The usual objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential native plant community for that site. Such management generally results in the maximum production of herbage, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential fits grazing needs, provides wildlife habitat, or provides other benefits as well as protecting soil and water resources.

Specific information about stocking range sites is not included in this publication. Help in classifying range sites, in estimating the condition of the range, and in determining the number of animals to stock can be obtained from technicians of the local agricultural agencies.

Claypan Prairie Range Site. This site consists of deep nearly level through gently sloping, loamy soils that have a clayey or loamy subsoil. These soils are on uplands.

Under continuous intensive grazing by cattle, little bluestem, big bluestem, switchgrass, indiangrass, leadplant, and Illinois bundleflower decrease in the plant community. Side-oats grama, blue grama, tall dropseed, goldenrod and shrubs increase. If overgrazing is allowed to continue for a long time, threeawns, silver bluestem, buffalograss, broomsedge bluestem, ragweeds, bitter sneezeweed, common broomweed, and woody plants replace many of the more desirable forage plants and make up a substantial part of the annual growth. Then, the total production of forage is greatly reduced.

Appropriate management practices on this site consist of regulating grazing, following a planned system of grazing, controlling weeds and brush, seeding desirable range plants, and developing well distributed and adequate supplies of water for livestock.

Deep Sand Savannah Range Site. This site consists of deep, nearly level through strongly sloping, sandy soils that have a sandy or loamy subsoil. These soils are on uplands.

Under continuous intensive grazing by cattle, little bluestem, big bluestem, indiangrass, switchgrass, and perennial forbs decrease in the plant community. Tall dropseed, purpletop, Scribner panicum, and oaks increase. If overgrazing is allowed to continue for a long time, broomsedge bluestem, splitbeard bluestem, low-growing panicums, ragweeds, camphorweed, annuals, and oaks replace many of the more desirable forage plants and make up a substantial part of the annual growth. Then, the total production of forage is greatly reduced.

Appropriate management practices on this site consist of regulating grazing, following a planned system of grazing and deferred grazing, seeding desirable range plants, controlling brush and weeds, and developing well distributed and adequate supplies of water for livestock.

Eroded Clay Range Site. This site consists of deep, gently sloping through sloping, severely eroded, loamy soils that have a clayey and loamy subsoil. These soils are on uplands.

Under continuous intensive grazing by cattle, indiangrass, little bluestem, side-oats grama, and perennial sun-

flowers decrease in the plant community. Buffalograss, tall dropseed, tridens, and silver bluestem increase. If overgrazing is allowed to continue for a long time, tumble windmillgrass, tumblegrass, tridens, annual warm and cool season grasses, common broomweed, and ragweeds replace many of the more desirable forage plants and make up a substantial part of the annual growth. Then, the total production of forage is greatly reduced, and annual soil loss is increased.

Appropriate management practices on this site consist of regulating grazing, following a planned system of grazing and deferred grazing, seeding desirable range plants, controlling weeds and brush, and developing well distributed and adequate supplies of water for livestock.

Eroded Prairie Range Site. This site consists of very gently sloping through sloping, severely eroded, loamy soils that have a loamy subsoil. These soils are on uplands.

Under continuous intensive grazing by cattle, indiangrass, little bluestem, big bluestem, and perennial sunflowers decrease in the plant community. Side-oats grama, purpletop, jointtail, tall dropseed, and silver bluestem increase. If overgrazing is allowed to continue for a long time, tumble windmillgrass, tumblegrass, broomsedge bluestem, annual warm and cool season grasses, common broomweed, and ragweeds replace many of the more desirable forage plants and make up a substantial part of the annual growth. Then, the total production of forage is greatly reduced, and annual soil loss is increased.

Appropriate management practices on this site consist of regulating grazing, following a planned system of grazing and deferred grazing, seeding desirable range plants, controlling weeds and brush, and developing well distributed and adequate supplies of water for livestock.

Eroded Sandy Savannah Range Site. This site consists of gently sloping through sloping, severely eroded, loamy soils that have a loamy subsoil. These soils are on uplands.

Under continuous intensive grazing by cattle, little bluestem, indiangrass, big bluestem, and switchgrass decrease in the plant community. Tall dropseed, jointtail, splitbeard bluestem, lovegrass, and oaks increase. If overgrazing is allowed to continue for a long time, broomsedge bluestem, threeawns, low-growing panicums, ragweeds, annuals, and oaks replace many of the more desirable forage plants and make up a substantial part of the annual growth. Then, the total production of forage is greatly reduced, and annual soil loss is increased.

Appropriate management practices on this site consist of regulating grazing, following a planned system of grazing and deferred grazing, seeding desirable range plants, controlling weeds and brush, and developing well distributed and adequate supplies of water for livestock.

Heavy Bottomland Range Site. This site consists of deep, nearly level, loamy and clayey soils that have a clayey subsoil. These soils are on flood plains.

Under continuous intensive grazing by cattle, big bluestem, switchgrass, indiangrass, prairie cordgrass, and perennial forbs decrease in the plant community. Tall dropseed, sedges, buffalograss, tridens, shrubs, and woody plants increase. If overgrazing is allowed to continue for a long time, seacoast sumpweed, ragweeds, ironweed, annual bromes, hawthorns, persimmons, and other woody species replace many of the more desirable forage plants and make up a substantial part of the annual growth. Then, the total production of forage is greatly reduced.

Appropriate management practices on this site consist of regulating grazing, following a planned system of grazing and deferred grazing, seeding desirable range plants, controlling weeds and brush, and developing well distributed and adequate supplies of water for livestock.

Loamy Bottomland Range Site. This site consists of deep, mostly nearly level and very gently sloping soils that are loamy throughout. These soils are on flood plains. A few minor areas of steeper soils are in this site.

Under continuous intensive grazing by cattle, little bluestem, indiangrass, switchgrass, eastern gamagrass, little bluestem, and compassplant decrease in the plant community. Beaked panicum, tall dropseed, sedges, and woody plants increase. If overgrazing is allowed to continue for a long time, annual brome, threeawns, johnsongrass, ragweeds, seacoast sumpweed, white snakeroot, hawthorns, and persimmons replace many of the more desirable forage plants and make up a substantial part of the annual growth. Then, the total production of forage is greatly reduced. Areas in poor condition are generally those that were formerly cultivated and that have been abandoned due to flooding.

Appropriate management practices on this site consists of regulating grazing, following a planned system of grazing, controlling weeds and brush, seeding desirable range plants, and developing well distributed and adequate supplies of water for livestock.

Loamy Prairie Range Site. This site consists of deep, nearly level through gently sloping, loamy soils that have a loamy or clayey subsoil. These soils are on uplands.

Under continuous intensive grazing by cattle, little bluestem, big bluestem, switchgrass, indiangrass, and wildryes decrease in the plant community. Tall dropseed, side-oats grama, jointtail, purpletop, coralberry, and smooth sumac increase. If overgrazing is allowed to continue for a long time, silver bluestem, annual bromes, threeawns, broomsedge bluestem, splitbeard bluestem, ragweeds, ironweed, common broomweed, annual forbs, elms, persimmons, and hawthorns replace many of the more desirable forage plants and make up a substantial part of the annual growth. Then, the total production of forage is greatly reduced.

Appropriate management practices on this site consist of regulating grazing, following a planned system of grazing, controlling weeds and brush, seeding desirable range plants, and developing well distributed and adequate supplies of water for livestock.

Red Clay Prairie Range Site. This range site consists of deep, gently sloping through strongly sloping, clayey and loamy soils that have a clayey subsoil. These soils are on uplands.

Very careful management is needed to maintain moderate productivity and prevent erosion. Under continuous intensive grazing by cattle, little bluestem, big bluestem, and indiangrass decrease in the plant community. Side-oats grama, buffalograss, tall dropseed, Texas grama, hairy grama, and perennial forbs increase. If overgrazing is allowed to continue for a long time, windmillgrass, silver bluestem, threeawns, broomweeds, ragweeds, and croton replace many of the more desirable forage plants and make up a substantial part of the annual growth. Then, the total percentage of forage is greatly reduced.

Appropriate management practices on this site consists of regulating grazing, following a planned system of grazing and deferred grazing, seeding desirable range plants, controlling weeds and brush, and developing well distributed and adequate supplies of water for livestock.

Sandy Bottomland Range Site. This site consists of deep, nearly level through very gently sloping, sandy soils that have a sandy subsoil. These soils are on flood plains.

Under continuous intensive grazing by cattle, switchgrass, sand bluestem, indiangrass, and Maximillian sunflower decrease in the plant community. Texas bluegrass, beaked panicum, purpletop, heath aster, and woody plants increase. If overgrazing is allowed to continue for a long time, dropseeds, annual brome, sandbur, cocklebur, goldenrods, Texas bullnettle, camphorweed, bagpod, and saltcedar replace many of the more desirable forage plants and make up a substantial part of the annual growth. The bagpod, a vigorous annual legume, is fatal to cattle.

Appropriate management practices on this site consist of regulating grazing, following a planned system of grazing and deferred grazing, controlling brush and weeds, seeding desirable range plants, and developing well distributed and adequate supplies of water for livestock.

Sandy Savannah Range Site. This site consists of deep and moderately deep, nearly level through strongly sloping, loamy soils that have a loamy or clayey subsoil. These soils are on uplands.

Under continuous intensive grazing by cattle, little bluestem, indiangrass, and big bluestem decrease in the plant community. Scribner panicum, side-oats grama, purpletop, dropseeds, sedges, and woody plants increase. If overgrazing is allowed to continue for a long time, an almost pure stand of post oak and blackjack oak with an understory of annual cool season grasses, sedges, low-growing panicums, greenbrier, and poison-ivy replace many of the more desirable forage plants and make up a substantial part of the annual growth. Then, the total production of forage is greatly reduced.

Appropriate management practices on this site consist of regulating grazing, following a planned system of grazing, controlling weeds and brush, seeding desirable range plants, and developing well distributed and adequate supplies of water for livestock.

Shallow Savannah Range Site. This site consists of shallow, sloping through strongly sloping soils that are loamy throughout. These soils are on uplands.

Under continuous intensive grazing by cattle, little bluestem, indiangrass, big bluestem, and perennial sunflower decrease in the plant community. Side-oats grama, hairy grama, tall dropseed, sumac, and coralberry increase. If overgrazing is allowed to continue for a long time, threeawns, splitbeard bluestem, ragweeds, common yarrow, and persimmons replace many of the more desirable forage plants and make up a substantial part of the annual growth. Then, the total production of forage is greatly reduced.

Appropriate management practices on this site consists of regulating grazing, following a planned system of grazing, controlling brush and weeds, seeding desirable range plants, and developing well distributed and adequate supplies of water for livestock.

Subirrigated Range Site. This site consists of deep, nearly level through very gently sloping, loamy and sandy soils that have a loamy or sandy subsoil. These soils have a high water table and are on flood plains.

Under continuous intensive grazing by cattle, switchgrass, big bluestem, indiangrass, prairie cordgrass, eastern gamagrass, common reed, and Maximillian sunflower decrease in the plant community. Dropseeds, scribner panicum, sedges, rushes, beaked panicum, purpletop, and woody species increase. If overgrazing is allowed to continue for a long time, johnsongrass, annual brome, broomsedge bluestem, ragweeds, and ironweed replace many of the more desirable forage plants and make up a substantial part of the annual growth. Then, the total production of forage is greatly reduced.

Appropriate management practices on this site consist of regulating grazing, following a planned system of grazing and deferred grazing, controlling weeds and brush, seeding desirable range plants, and developing well distributed and adequate supplies of water for livestock.

Wetland Range Site. This site consists of deep, nearly level through very gently sloping, clayey and loamy soils that have a clayey and loamy subsoil. These soils are wet and are on flood plains.

Under continuous intensive grazing by cattle, switchgrass, indiangrass, big bluestem, and little bluestem decrease in the plant community. Beaked panicum, bushy bluestem, sedges, and rushes decrease and cattails and seacoast sumpweed and other water plants increase. If overgrazing and grazing during wet periods are allowed to continue, woody plants replace many of the more desirable forage plants and make up a substantial part of the annual growth.

Maintenance of fences and surface drainage are constant concerns on this site.

Appropriate management practices on this site consist of regulating grazing, following a planned system of grazing, and controlling brush.

Woodland Management and Productivity

Table 7 contains information useful to woodland owners or forest managers planning use of soils for wood crops. Mapping unit symbols for those soils suitable for wood crops are listed in numerical order, and the woodland suitability group for each soil is given. All soils in each group require the same general kinds of woodland management and have about the same potential productivity.

The first part of the symbol, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates no significant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the order in which the letters are listed above—x, w, t, d, c, s, f, and r.

The third part, a number, indicates the degree of hazard or limitation and the general suitability of the soils for certain kinds of trees. The numeral *4* indicates the soils have no significant limitation and are best suited to broadleaf trees; *5* indicates the soils have a slight to moderate limitation and are best suited to broadleaf trees; *6* indicates the soils have a moderate to severe limitation and are best suited to broadleaf trees.

In table 7 the soils are also rated for a number of factors to be considered in management. The ratings of slight, moderate, and severe are used to indicate the degree of major soil limitations.

Ratings of the erosion hazard indicate the risk of loss of soil in well-managed woodland. The risk is *slight* if the expected soil loss is small; *moderate* if some measures are needed to control erosion during logging and road construction; and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of equipment limitation reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or equipment; *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree that the soil affects expected mortality of planted tree seedlings when plant competition is not a limiting factor. The ratings are for seedlings from good planting stock when the seedlings are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortaility of the planted seedlings is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of plant competition indicate the degree to which undesirable plants are expected to invade or grow if openings are made in the tree canopy. The invading plants compete with native plants or planted seedlings by impeding or preventing their growth. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* means that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed for the control of undesirable plants.

The potential productivity of merchantable trees on a soil is expressed as a site index. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands.

Trees to plant are those that are suitable for commercial wood production and that are suited to the soils.

Woodland Understory Vegetation

Understory vegetation consists of grasses, forbs, shrubs, and other plants within the reach of livestock or of grazing or browsing wildlife. A well-managed wooded area can produce enough understory vegetation to support optimum numbers of livestock or wildlife, or both.

The quantity and quality of understory vegetation vary with the kind of soil, the age and kind of trees, the density of the canopy, and the depth and condition of the forest litter. The density of the forest canopy is a major influence in that it affects the amount of light that understory plants receive during the growing season.

Table 8 shows, for each soil suitable for woodland, the potential for producing understory vegetation. The table also lists the common names of the major native understory plants that grow on a specified soil and the percentage composition of each by air-dry weight. The kind and percentage of understory plants listed in the table are those to be expected where canopy density is most nearly typical of forests that yield the highest production of wood crops.

The potential production of understory vegetation is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year soil moisture is above average during the optimum part of the growing season; in a normal year soil moisture is average; and in an unfavorable year it is below average.

Windbreaks and Environmental Plantings

NORMAN E. SMOLA, forester, Soil Conservation Service, helped prepare this section.

Windbreaks are established to protect livestock, buildings, and yards from winds and snow. Windbreaks also help protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of both broad-leaved and coniferous species provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field, the interval depending on erodibility of the soil. They protect cropland and crops from wind and hold snow on the fields, and they also provide food and cover for wildlife.

Environmental plantings help to beautify and screen homes and other buildings and to abate noise around them. The plants, mostly evergreen shrubs and trees, are closely spaced. Healthy planting stock of suitable species planted properly on a well prepared site and maintained in good condition can insure a high degree of plant survival.

Stands of post oak, blackjack oak, and hickory grow on Chigley, Darnell, Eufaula, Galey, Dougherty, Konawa, Noble, Stephenville, Weatherford, and Windthorst soils. Other tree and shrub cover is mostly limited to the flood plains along the major rivers and creeks and their tributaries. Major species in such areas include elm, ash, pecan, and hackberry. Cottonwood grows along the North and South Canadian Rivers. Other native species include: sycamore, chinquapin oak, black walnut, bur oak, Shumard oak, persimmon, black willow, buttonbush, plum, blackhaw, chittamwood, roughleaf dogwood, hawthorn, redbud, and some osageorange, black locust, mulberry, white oak, river birch, flowering dogwood, and western soapberry. Except for their watershed, wildlife, and esthetic values, natural stands of trees on uplands have only limited economic benefits.

On most soils, preparation for tree planting can be the same as preparation for ordinary field crops. Even though many of the species planted are native to this county, they do not grow naturally on soils where trees are needed. Therefore, they need special care. Soils not subject to severe erosion can be prepared far enough in advance to allow them to settle before planting trees. Alfalfa and grass sod can be summer fallowed for at least one year before planting, and cropland can be fall plowed. Adequate cover or crop residue needs to be maintained on soils subject to severe erosion. Cover crops protect the soil both before and after planting and also protect the young seedlings.

Careful planning is needed for every tree planting if it is to be successful. When choosing stock for planting, it is preferable to select species that grow best on the type of soil at the planting location. The soils in Pottawatomie County with similar characteristics that affect tree growth have been placed in windbreaks tree suitability groups. The recommended trees and shrubs for the soils in each of these groups are included in the description of each group. Healthy seedlings are planted in late winter or early spring. The seedlings must be protected against drying, and the soil needs to be packed firmly against the roots.

Young trees need considerable care if they are to survive and do well on most of the soils of Pottawatomie County. With limited and irregular rainfall, weeds must be controlled so they do not compete with the seedlings for moisture. Trees must be protected from livestock and fire. Additional information on the appropriate design for the desired purpose and on the planting and care of tree plantings is available from the Soil Conservation Service and the State Forester and Extension Forester serving the county.

The kind of soil and the soil-air-moisture relationship greatly influence the growth of trees in this area. Trees normally grow best on deep, loamy soils. Only fair to poor growth is made on clayey soils because they absorb and release moisture too slowly. Deep soils are better suited to tree growth than are shallow soils because more moisture is available during droughty periods and there is more space for root development. Hardwoods require deeper soils than conifers, although conifers make their best growth on deeper soils.

At first, conifers such as pine and eastern redcedar grow more slowly than hardwoods, but their growth is likely to equal that of most hardwoods as they mature. Conifers surpass hardwoods in overall effectiveness as a windbreak or screen.

Available soil moisture, soil fertility, tree spacing, tree adaptability to the soil and care given to the tree all affect the rate of tree growth.

The soils in Pottawatomie County have been placed in nine windbreak tree suitability groups. The soils in each group have similar characteristics that affect tree growth. To find the soils in each group, refer to the description of each mapping unit in the section "Descriptions of the Soils."

Following is a brief description of each windbreaks tree suitability group with a list of trees and shrubs suitable for planting on the soils in each group. The estimated heights at age 20 for certain species recommended for planting are stated in the description of each group.

Windbreaks Tree Suitability Group 1. This group consists of deep, moderately coarse textured, coarse textured, and fine textured, somewhat poorly drained and poorly drained soils on nearly level through very gently sloping flood plains.

These soils have a water table at a depth of less than 40 inches during most of the growing season. Only trees and shrubs tolerant of a high water table are suited to these soils. The Harjo clay is not suited to trees unless surface drainage is improved. No data are available on expected tree heights.

Trees and shrubs suitable for planting are: Broadleafs—eastern cottonwood, black willow, weeping willow; shrubs—roughleaf dogwood, common buttonbush; conifers are not suited.

Windbreaks Tree Suitability Group 2. This group consists of deep, coarse textured, somewhat excessively drained soils on nearly level through very gently sloping flood plains. Periodic soil droughtiness and blowing sand

are principal hazards to seedling establishment. Some seedling mortality can be expected where these soils are subject to prolonged flooding.

Estimated tree heights, in feet, at age 20 are 60 for eastern cottonwood and 27 for eastern redcedar.

Trees and shrubs suitable for planting are: broadleafs—eastern cottonwood, American sycamore, osageorange; shrubs—Chickasaw plum; conifers are not suited.

Windbreaks Tree Suitability Group 3. This group consists of deep, moderately coarse textured, well drained soils on nearly level through very gently sloping flood plains. Moisture competition from weeds and grasses is the principal hazard to tree establishment. On areas subject to prolonged inundation, some mortality can be expected in new tree plantings.

Estimated tree heights, in feet, at age 20 are 65 for eastern cottonwood, 30 for eastern redcedar, and 40 for loblolly pine.

Trees and shrubs suitable for planting are: conifers—eastern redcedar, Austrian pine, loblolly pine; broadleafs—eastern cottonwood, American sycamore, pecan, Chinese pistache, Russian mulberry, osageorange, eastern redbud; shrubs—autumn-olive, Chickasaw plum, smooth sumac. The conifers listed as suitable for planting should not be planted in areas of prolonged flooding.

Windbreaks Tree Suitability Group 4. This group consists of deep; moderately fine textured, medium textured, and moderately coarse textured; well drained and moderately well drained soils on nearly level through very gently sloping flood plains. Minor areas of steeper soils slopes are also in this group. Moisture competition from weeds and grasses are principal hazards to tree establishment.

Estimated tree heights, in feet, at age 20 are 75 for eastern cottonwood, 55 for green ash, 35 for eastern redcedar, 35 for Austrian pine, and 45 for loblolly pine.

Trees and shrubs suitable for planting are: conifers—eastern redcedar, Austrian pine, loblolly pine, Scotch pine, Japanese black pine; broadleafs—eastern cottonwood, green ash, hackberry, American sycamore, bur oak, pecan, black walnut, osageorange, Russian mulberry, eastern redbud, Shumard oak, baldcypress, sweetgum, sugar maple, flowering dogwood; shrubs—autumn-olive, lilac, Chickasaw plum. The conifers listed as suitable for planting can be killed if the soil is inundated during seedling stage.

Windbreaks Tree Suitability Group 5. This group consists of deep, fine textured and moderately fine textured, somewhat poorly drained and moderately well drained soils on nearly level flood plains. Periodic soil droughtiness and moisture competition from weeds and grasses are the principal hazards to tree establishment.

Estimated tree heights, in feet, at age 20 are 60 for eastern cottonwood and 40 for green ash.

Trees and shrubs suitable for planting are: broadleafs—cottonwood, green ash, pecan, Shumard oak, hackberry, Kentucky coffeetree, bur oak, Russian mulberry, osageorange, thornless honeylocust, eastern redbud; shrubs—lilac; conifers are not suited.

Windbreaks Tree Suitability Group 6. This group consists of deep, medium textured and moderately coarse textured, well drained and moderately well drained soils on nearly level through gently sloping uplands. Soil droughtiness and competition from weeds and grasses are the principal hazards to tree establishment.

Estimated tree heights, in feet, at age 20 are 30 for eastern redcedar and 20 for osageorange.

Trees and shrubs suitable for planting are: conifers—eastern redcedar; broadleafs—osageorange, thornless honeylocust, hackberry, Russian mulberry, eastern redbud; shrubs—lilac.

Windbreaks Tree Suitability Group 7. This group consists of deep, coarse textured, somewhat excessively drained soils on nearly level through sloping uplands Periodic droughtiness and blowing sand are principal hazards to seedling establishment during most years.

Estimated tree height, in feet, at age 20 is 22 for eastern redcedar.

Trees and shrubs suitable for planting are: conifers—eastern redcedar, Scotch pine; broadleafs—black locust, osageorange; shrubs—Chickasaw plum, Russian-olive.

Windbreaks tree Suitability Group 8. This group consists of deep, moderately deep, and shallow; medium textured, moderately coarse textured, and coarse textured; well drained, moderately well drained, and somewhat excessively drained soils on nearly level through strongly sloping uplands. Competition from weeds and grasses is the principal hazard to tree establishment. Droughtiness and blowing sand are hazards to tree establishment on Dougherty and Konawa loamy fine sands.

Estimated tree heights, in feet, at age 20 are 30 for eastern redcedar, 30 for Austrian pine, 40 for loblolly pine, and 35 for shortleaf pine.

Trees and shrubs suitable for planting are: conifers—eastern redcedar, Austrian pine, loblolly pine, Scotch pine, Japanese black pine; broadleafs—eastern cottonwood, green ash, hackberry, sycamore, bur oak, pecan, black walnut, osageorange, Russian mulberry, eastern redbud, Shumard oak, sweetgum, sugar maple, roughleaf dogwood; shrubs—autumn-olive, lilac, Chickasaw plum.

Windbreaks Tree Suitability Group 9. This group consists of deep; moderately fine textured, fine textured, and medium textured; well drained and poorly drained soils on nearly level through strongly sloping uplands. Borrow Pits and Gravel Pits are in this group. Inadequate rooting depth, extreme droughtiness, and the alkali subsoil make these soils generally unsuitable for tree plantings.

Engineering

FORREST MCCLUNG, engineer, Soil Conservation Service, assisted in the preparation of this section.

This section provides information about the use of soils for building sites, sanitary facilities, construction materi-

als, and water management. Among those who can benefit from this section are engineers, landowners, community decision makers and planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in tables in this section are based on test data and estimated data in the "Soil Properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by the soil survey and used in determining the ratings in this section are grain-size distribution, liquid limit, plasticity index, soil reaction, depth to and hardness of bedrock within 5 or 6 feet of the surface, soil wetness characteristics, depth to a seasonal water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

Based on the information assembled about soil properties, ranges of values may be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values may be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to—(1) select potential residential, commercial, industrial, and recreational areas; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternate routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternate sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations and testing.

The information is presented mainly in tables. Table 9 shows, for each kind of soil, ratings of the degree and kind of limitations for building site development; table 10, for sanitary facilities; and table 12, for water management. Table 11 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have different meanings in soil science and in engineering; many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 9. A *slight* limitation indicates that soil properties are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are used for pipelines, sewerlines, telephone and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by the wetness caused by a high seasonal water table, the texture and consistence of soils, the tendency of soils to cave in or slough, and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is defined, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and small commercial buildings referred to in table 9 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence from settling or

shear failure of the foundation do not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and the large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious limitation.

Local roads and streets referred to in table 9 have an all-weather surface that can carry light to medium traffic all year. They consist of subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The AASHTO and Unified classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones, all of which affect stability and ease of excavation, were also considered.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that deal with the ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 10 shows the degree and kind of limitations of each soil for these uses and for use of the soil as daily cover for landfills.

If the degree of soil limitation is indicated by the rating *slight*, soils are favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance are required.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that effect the absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and a shallow depth to bedrock interfere with installation. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas. Also, soil erosion and soil slippage are hazards where absorption fields are installed in sloping soils.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and as a result ground water supplies in the area may be contaminated. Soils having a hazard of inadequate filtration are indicated by footnotes in table 10.

Percolation tests are performed to determine the absorptive capacity of the soil and its suitability for septic tank absorption fields. These tests should be performed during the season when the water table is highest and the soil is at minimum absorptive capacity.

In many of the soils that have moderate or severe limitations for septic tank absorption fields, it may be possible to install special systems that lower the seasonal water table or to increase the size of the absorption field so that satisfactory performance is achieved.

Sewage lagoons are shallow ponds constructed to hold sewage while bacteria decompose the solid and liquid wastes. Lagoons have a nearly level flow area surrounded by cut slopes or embankments of compacted, nearly impervious soil material. They generally are designed so that depth of the sewage is 2 to 5 feet. Impervious soil at least 4 feet thick for the lagoon floor and sides is required to minimize seepage and contamination of local ground water. Soils that are very high in organic matter and those that have stones and boulders are undesirable. Unless the soil has very slow permeability, contamination of local ground water is a hazard in areas where the seasonal high water table is above the level of the lagoon floor In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce its capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the location of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soils affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste, either in excavated trenches or on the surface of the soil. The waste is spread compacted in layers and covered with thin layers of soil. Landfill areas are subject to heavy vehicular traffic. Ease of excavation, risk of polluting ground water, and trafficability affect the suitability of a soil for this purpose. The best soils have a loamy or silty texture, have moderate or slow permeability, are deep to bedrock and a seasonal water table, are free of

large stones and boulders, and are not subject to flooding. In areas where the seasonal water table is high, water seeps into the trenches and causes problems in excavating and filling the trenches. Also, seepage into the refuse increases the risk of pollution of ground water. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability that might allow noxious liquids to contaminate local ground water.

Unless otherwise stated, the ratings in table 10 apply only to soil properties and features within a depth of about 6 feet. If the trench is deeper, ratings of slight or moderate may not be valid. Site investigation is needed before a site is selected.

In the area type of sanitary landfill, refuse is placed on the surface of the soil in successive layers. The limitations caused by soil texture, depth to bedrock, and stone content do not apply to this type of landfill. Soil wetness, however, may be a limitation because of difficulty in operating equipment.

Daily cover for sanitary landfills should be soil that is easy to excavate and spread over the compacted fill during both wet and dry weather. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

In addition to these features, the soils selected for final cover of landfills should be suitable for growing plants. In comparison with other horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas, such as slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of road fill, sand, gravel, and topsoil is indicated in table 11 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed and described as the survey is made, generally about 6 feet.

Road fill is soil material used in embankments for roads. The ratings reflect the ease of excavating and working the material and the expected performance of the material after it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about soil properties that determine such performance is given in the descriptions of soil series.

The ratings apply to the soil profile between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within the profile. The estimated engineering properties in table 15 provide more specific information about the nature of each horizon that can help determine its suitability for road fill.

According to the Unified soil classification system, soils rated *good* have low shrink-swell potential, low potential frost action, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as high shrink-swell potential, high potential frost action, steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*, regardless of the quality of the suitable material.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 11 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 15.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to sustain the growth of plants. Also considered is the damage that would result to the area from which the topsoil is taken.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones, are low in content of gravel and other coarse fragments, and have gentle slopes. They are low in soluble salts, which can limit plant growth. They are naturally fertile or respond well to fertilization. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils, very firm clayey soils, soils with suitable layers less than 8 inches thick, soils having large amounts of gravel, stones or soluble salt, steep soils, and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter a surface horizon is much preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of

moisture and nutrients for plant growth are greatly increased by organic matter. Consequently, careful preservation and use of material from these horizons is desirable.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 12 the degree of soil limitation and soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Soil and site limitation are expressed as slight, moderate, and severe. *Slight* means that the soil properties and site features are generally favorable for the specified use and that any limitation is minor and easily overcome. *Moderate* means that some soil properties or site features are unfavorable for the rated use but can be overcome or modified by special planning and design. *Severe* means that the soil properties and site features are so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive maintenance is required.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for this use have low seepage potential, which is determined by the permeability and depth over fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and is of favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Drainage of soil is affected by such soil properties as permeability, texture, structure, depth to claypan or other layers that influence rate of water movement, depth to the water table, slope, stability of ditchbanks, susceptibility to flooding, salinity and alkalinity, and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments, or a combination of channels and ridges, constructed across a slope to intercept runoff and allow the water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity of slope and steepness, depth to bedrock or other unfavorable material, permeability, ease of establishing vegetation, and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff at nonerodible velocities to outlets. Features that affect the use of soils for waterways are slope, permeability, erodibility, and suitability for permanent vegetation.

Wildlife Habitat

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the development of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, inadequate, or inaccessible, wildlife will either be scarce or will not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by properly managing the existing plant cover, and by fostering the natural establishment of desirable plants.

In table 13 the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in—

1. Planning the use of parks, wildlife refuges, nature study areas, and other developments for wildlife.
2. Selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat.
3. Determining the intensity of management needed for each element of the habitat.
4. Determining areas that are suitable for acquisition to manage for wildlife.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderate intensity of management and fairly frequent attention are required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and requires intensive effort. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. Examples are corn, sorghum, wheat, oats, barley, millet, cowpeas, soybeans, and sunflowers. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Examples are fescue, lovegrass, switchgrass, bromegrass, clover, alfalfa, and crownvetch. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations.

Wild herbaceous plants are native or naturally established herbaceous grasses and forbs, including weeds, that provide food and cover for wildlife. Examples are bluestem, indiangrass, goldenrod, beggarweed, pokeweed, partridgepea, Ragweed, annual sunflower, native lespedeza, Maxmillion sunflower, Croton, and grama. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations.

Hardwood trees and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Examples of native plants are oak, hawthorn, dogwood, persimmon, hickory, black walnut, mulberry, blackberry, grape, blackhaw, viburnum, oaks, pecan, chittam, and osageorange. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated good are Russian-olive, autumn-olive, and crabapple. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness.

Coniferous plants are cone-bearing trees, shrubs, or ground cover that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. An example is redcedar, and juniper. Major soil properties that affect the growth of coniferous plants are depth of the root zone, available water capacity, and wetness.

Shrubs are bushy woody plants that produce fruits, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Examples are buckbrush, sumac, roughleaf dogwood, sand plum, and green biars. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Examples of wetland plants are smartweed, wild millet, rushes, sedges, reeds, cordgrass, and cattail. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness.

Shallow water areas are bodies of surface water that have an average depth of less than 5 feet and are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control devices in marshes or streams. Examples are muskrat marshes, waterfowl feeding areas, wildlife watering developments, beaver ponds, and farm floodwater detention structures. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of croplands, pastures, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include bobwhite quail, meadowlark, field sparrow, killdeer, cottontail rabbit, and red fox.

Woodland habitat consists of hardwoods or conifers or a mixture of both, with associated grasses, legumes, and wild herbaceous plants. Examples of wildlife attracted to this habitat are wild turkey, woodcock, thrushes, vireos, woodpeckers, tree squirrels, grey fox, raccoon, and deer.

Wetland habitat consists of water-tolerant plants in open, marshy, or swampy shallow water areas. Examples of wildlife attracted to this habitat are ducks, geese, herons, shore birds, rails, kingfishers, muskrat, mink, and beaver.

Rangeland habitat consists of wild herbaceous plants and shrubs on range. Examples of wildlife attracted to this habitat are antelope, white-tailed deer, quail, cottontail, meadowlark, and lark bunting.

Recreation

The soils of the survey area are rated in table 14 according to limitations that affect their suitability for camp areas, picnic areas, playgrounds, and paths and trails. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreational use by the duration of flooding and the season when it occurs. Onsite assessment of height, duration, and frequency of flooding is essential in planning recreational facilities.

In table 14 the limitations of soils are rated as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 14 can be supplemented by additional information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 10, and interpretations for dwellings without basements and for local roads and streets, given in table 9.

Camp areas require such site preparation as shaping and leveling tent and parking areas, stablizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over rock should be sufficient to allow necessary grading.

The design and layout of paths and trails for walking, horseback riding, and bicycling should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Soil Properties

Extensive data about soil properties collected during the soil survey are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of samples selected from representative soil profiles in the field.

When he makes soil borings during field mapping, the soil scientist can identify several important soil properties. He notes the seasonal soil moisture condition, or the presence of free water and its depth in the profile. For each horizon, he notes the thickness of the soil and its color; the texture, or the amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or natural pattern of cracks and pores in the undisturbed soil; and the consistence of soil in place under the existing soil moisture conditions. He records the root depth of existing plants, determines soil pH or reaction, and identifies any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to characterize key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many of the soil series are available from nearby areas.

Based on summaries of available field and laboratory data, and listed in tables in this section, are estimated ranges in engineering properties and classifications and in physical and chemical properties for each major horizon of each soil in the survey area. Also, pertinent soil and water features, engineering test data, and data obtained from laboratory analyses, both physical and chemical, are presented.

Engineering Properties

Table 15 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area. These estimates are presented as ranges in values most likely to exist in areas where the soil is mapped.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Information is presented for each of these contrasting horizons. Depth to the upper and lower boundaries of each horizon in a typical profile of each soil is indicated. More information about the range in depth and in properties of each horizon is given for each soil series in the section "Descriptions of the Soils."

Texture is described in table 15 in standard terms used by the United States Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms used by USDA are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (USCS) (*2*) and the American Association of State Highway and Transportation Officials Soil Classification System (AASHTO) (*1*). In table 15 soils in the survey area are classified according to both systems.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils,

identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example CL-ML.

The AASHTO system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified as A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or more for the poorest. In table 15 the percentage, by weight, of cobbles or the rock fragments more than 3 inches in diameter are estimated for each major horizon. These estimates are determined largely by observing volume percentage in the field and then converting it, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four standard sieves is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior.

Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

Physical and Chemical Properties

Table 16 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the representative profile of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships between the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for water movement in a vertical direction when the soil is saturated. Not considered in the estimates are lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in the plannning and design of drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops and ornamental or other plants to be grown, in evaluating soil amendments for fertility and stabilization, and in evaluating the corrosivity of soils.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others it was estimated on the basis of the kind of clay and on measurements of similar soils. Size of imposed loadings and the magnitude of changes in soil moisture content are also important factors that influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A *high* shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion, as used in table 16, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rating of soils for corrosivity to concrete is based mainly on the sulfate content, soil texture, and acidity. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Installations of steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely within one kind of soil or within one soil horizon.

Erosion factors are used to predict the amount of erosion that will result from specific kinds of land treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or wind, that can occur without reducing crop production or environmental quality.

Wind erodibility groups are used to predict the susceptibility of soils to blowing and to predict the amount of soil lost by blowing. The groups consist of soils that have similar properties that affect soil blowing, principally

those that determine the stability of aggregates that resist breakdown by tillage and abrasion by wind. Among properties of soils that affect their placement in wind erodibility groups are texture, organic matter content, content of calcium carbonate, soil moisture, mineral composition, susceptibility to frost action, and size and stability of aggregates.

Soil and Water Features

Features that relate to runoff or infiltration of water, to flooding, to grading and excavation of each soil are indicated in table 17. This information is helpful in planning land uses and engineering projects that are likely to be affected by the amount of runoff from watersheds, by flooding and a seasonal high water table, by the presence of bedrock in the upper 5 or 6 feet of the soil.

Hydrologic groups are used to estimate runoff after rainfall. Soil properties that influence the minimum rate of infiltration into the bare soil after prolonged wetting are depth to a water table, water intake rate and permeability after prolonged wetting, and depth to layers of slowly or very slowly permeable soil.

Flooding is rated in general terms that describe the frequency, duration, and period of the year when flooding is most likely. The ratings are based on evidences in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; absence of distinctive soil horizons that form in soils of the area that are not subject to flooding; local information about floodwater heights and the extent of flooding; and local knowledge that relates the unique landscape position of each soil to historic floods. Most soils in low positions on the landscape where flooding is likely to occur are classified as fluvents at the suborder level or as fluventic subgroups. See the section "Classification of the Soils."

The generalized description of flood hazards is of value in land use planning and provides a valid basis for land use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

A seasonal high water table is the highest level of a saturated zone more than 6 inches thick in soils for continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed during the course of the soil survey. Indicated are the depth to the seasonal high water table; the kind of water table, whether perched, artesian, or the upper part of the ground water table; and the months of the year that the high water commonly is present. Only those saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not to construct basements and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at depths of 5 to 6 feet or less. For many soils, limited ranges in depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and other observations during the soil mapping. The kind of bedrock and its relative hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Test data

Table 18 contains engineering test data for some of the major soil series in Pottawatomie County. These tests were made to help evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits. The mechanical analyses were made by combined sieve and hydrometer methods.

Shrinkage limit is the percentage of moisture at which shrinkage of the soil material stops.

Shrinkage ratio is the relation of change in volume of the soil material to the water content of the soil material when at the shrinkage limit. The change in volume is expressed as a percentage of the air-dry volume of the soil material, and the water content is expressed as a percentage of the weight of oven-dry soil material.

The data on volume change indicate the amount of shrinkage and swelling that is obtained from the sample prepared at optimum moisture content, and then subjected to drying and wetting. The total change that can occur in a specified soil is the sum of the value given for shrinkage and for swelling.

Test to determine liquid limit and plastic limit measure the effect of water on the consistence of soil material as has been explained in table 15.

Classification of the Soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil Taxonomy," (a basic system of soil classification for making and interpreting soil surveys) available in the SCS State Office, Stillwater, Oklahoma.

The system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the bases for classification are the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 19 the soils of the survey area are classified according to the system. Classes of the system are briefly discussed in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol.* An example is Entisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and that are important to plant growth or that were selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. The name of a great group ends with the name of a suborder. A prefix added to the name suggests something about the properties of the soil. An example is Haplaquents (*Hapl*, meaning simple horizons, plus *aquent*, the suborder of Entisols that have an aquic moisture regime).

SUBGROUP. Each great group is divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades that have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. The names of subgroups are derived by placing one or more adjectives before the name of the great group. The adjective *Typic* is used for the subgroup that is thought to typify the great group. An example is Typic Haplaquents.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, mixed, nonacid, mesic, Typic Haplaquents.

SERIES. The series consists of a group of soils that are formed from a particular kind of parent material and have horizons that, except for texture of the surface soil, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Formation of the Soils

In this section the factors of soil formation and the processes of soil formation are discussed. Table 19 in the section "Classification of the Soils" gives the classification of each soil series of Pottawatomie County by higher categories.

Factors of Soil Formation

The properties of the soil at any given place result from the integrated effects of five major factors of soil formation—parent material, climate, plants and animals, relief, and time. Few generalizations can be made regarding the effect of any one factor because the effect of each is modified by the other four.

Parent material

Parent material is one of the most influential factors of soil formation in the county. It sets the limits of the chemical and mineral composition of the soil, and it influences the rate of soil development. Parent material is the unconsolidated materal from which soil formed.

Pottawatomie County has several kinds of parent material, and all produced different soils. Soils formed in material weathered from shale, for example Aydelotte soils, have a clayey subsoil. Those formed in material weathered from sandstone, such as Zaneis soils, have a loamy subsoil. Examples of soils that formed in clayey, loamy, or sandy sediment on uplands are Kirkland, Vanoss, and Eufaula soils. Examples of soils that formed in clayey, loamy, or sandy sediment on flood plains are Miller, Port, and Gaddy soils.

Climate

The moist, subhumid continental climate of Pottawatomie County is characterized by rains of high intensity. Moisture and warm temperatures have been sufficient to promote the formation of distinct horizons in many of the soils. Differences in soils, however, cannot be attributed to the climate because the climate is uniform throughout the county. Heavy rains have caused rapid runoff that has eroded many soils. This erosion is an indirect effect of climate.

Plants and animals

Plants, burrowing animals, insects, and soil micro-organisms have a direct influence on the formation of soil.

Native vegetation, such as trees or grasses or a combination of both, has a bearing on the amount of organic matter, amounts and kinds of plant nutrients, and the type of soil structure and consistence. The Vanoss soils formed under native grasses. The fibrous roots of these native grasses promote good granular structure that is high in organic-matter content. This type of vegetation reduces loss of soil nutrients by the recycling and by the feeding ability of the deep grass roots. Consequently, the soils that formed under grass in Pottawatomie County tend to have more bases and organic matter than the soils that formed under trees. The Stephenville soils formed under trees and are therefore lower in plant nutrients and organic matter than those that formed under grasses.

During the past century man has altered this soil-forming process by removing the native vegetation over much of the county. Lack of adequate conservation measures has resulted in much soil loss through sheet and gully erosion.

Relief

Relief affects soil formation through its influence on moisture, drainage, erosion, temperature, and plant cover. The relief of Pottawatomie County is determined largely by the resistance of underlying parent material to weathering and geological erosion. In about 20 percent of Pottawatomie County, the soils are on nearly level or very gently sloping flood plains, and in about 80 percent, they are on uplands.

The effects of relief on soil formation is illustrated by Weatherford and Darnell soils, both of which formed in material weathered from sandstone. The Weatherford soils generally are in areas of less sloping relief. Surface runoff is less, and more water percolates through these soils to influence the loss, gain, or transfer of soil constituents. The Darnell soils are in areas of more sloping relief and have a less clearly defined profile than Weatherford soils. On the more sloping soils, more of the rainwater runs off instead of moving through the soil to help in the formation of a deeper solum.

Time

Time as a factor in soil formation cannot be measured strictly in years. The length of time needed for the development of genetic horizons depends on the intensity and the interactions of soil-forming factors in promoting the losses, gains, transfers, or transformations of soil constituents that are necessary for forming soil horizons. Soils with no definite genetic horizons are young or immature. Mature or older soils have approached equilibrium with their envioronment and tend to have well-defined horizons.

The soils of Pottawatomie County range from young to old. Some of the old, mature soils are Kirkland and Carytown soils on uplands. The Zaneis and Stephenville soils are younger, but they have well-expressed soil horizons. The Vernon and Darnell soils are young soils. They have had sufficient time to develop well-expressed horizons, but because they are sloping, geologic erosion has taken away soil material almost as fast as it is formed. The Pulaski and Yahola soils are on flood plains and have been forming for such a short time that they show little horizon development.

Processes of Soil Formation

Processes that have influenced the formation of horizons in the soils of Pottawatomie County are accumulation of organic matter, leaching of calcium carbonates and bases, and translocation of silicate clay minerals. In most soils, more than one of these processes has been active in the development of horizons. Some processes have slowed horizon differentiation.

By adding organic matter to the surface layer, native grasses have contributed to the granular structure of that layer in soils on the prairie. These granular surface layers that are high in organic-matter content, such as the surface layer of Vanoss soils, are called mollic epipedons in the classification system. Stephenville soils formed in material weathered from sandstone under native trees. They contain less organic matter than Vanoss soils, and their surface layer is called an ochric epipedon.

Leaching of calcium carbonates and bases is active in the formation of soils. The accumulation of calcium carbonates and bases in the lower part of the B horizon of the Aydelotte soils indicates the depth to which water has percolated. The Vanoss, Teller, and Zaneis soils have been leached to the extent that they have no accumulation of calcium carbonates. Konawa, Dougherty, and Eufaula soils have a distinct A2 horizon that has been leached of bases. The B horizon of these soils has had much leaching of bases, and this is reflected by their base saturation.

Soils on flood plains, for example Gaddy and Yahola soils, are recharged with bases during each flood. The Pulaski soils have not been leached, but their sediment comes from the leached, acid soils. The Vernon soils, which formed in Permian red beds, are high in carbonates. Calcium carbonates in Vernon soils are related to the nature of the parent material rather than to leaching.

The translocation of silicate clay minerals is very important in the properties and classification of soils. Argillic horizons are diagnostic for classification. Clay films on ped surfaces and bridging sand grains and increases in total clay are used in the field as evidence of argillic horizons. The argillic horizon is present in Kirkland, Renfrow, and Stephenville soils. The varying degrees of translocation of silicate clay minerals and the kind of parent material have resulted in wide variation in the texture and other properties of the argillic horizons of soils in Pottawatomie County. The Stephenville, Konawa, Dougherty, and Eufaula soils have a surface layer that is more intensely leached of silicate clay minerals than the surface layer of other soils in the county.

The grasses on the soils of the prairie bring bases to the surface and thus retard complete leaching and forma-

tion of an A2 horizon. Geological erosion on gently sloping to strongly sloping Vernon and Darnell soils hinders horizonation through soil losses. The sediment of the Yahola, Pulaski, and other soils on flood plains was deposited so recently that there has not been enough time for the formation of horizons.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single mapping unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Low	Less than 4
Moderate	4 to 6
High	More than 6

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

Buried soil. A buried soil, once exposed but now overlain by more recently developed soil.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Complex, soil. A mapping unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Compressible. Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Cutbanks cave. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for

long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Fast intake. The rapid movement of water into the soil.

Favorable. Favorable soil features for the specified use.

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Forb. Any herbaceous plant not a grass or a sedge.

Granule. A single mass, or cluster, of many individual soil particles.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Leached layer. A layer from which the soluble materials have been dissolved and washed away by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Low strength. Inadequate strength for supporting loads.

Mature soil. Any soil with well developed horizons having characteristics produced by the natural processes of soil formation and in near equilibrium with its present envrironment.

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three single variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Plant nutrients are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from the air and water.

Organic matter. A general term for plant and animal material, in or on the soil, in all stages of decomposition. Readily decomposed organic matter is often distinguished from the more stable forms that are past the stage of rapid decomposition.

Overgrazing. Grazing so heavy as to impair future forage production and to deteriorate plants or soil, or both. Contrasts with undergrazing.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the bases of differences in slope, stoniness, thickness or some other characteristic that affects management. These differences are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water of subsurface tunnels or pipelike cavities in the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. Locally, a small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slow intake. The slow movement of water into the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt*, *silt loam*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Unstable fill. Risk of caving or sloughing in banks of fill material.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to a soil or soil material consisting of particles well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

ILLUSTRATIONS

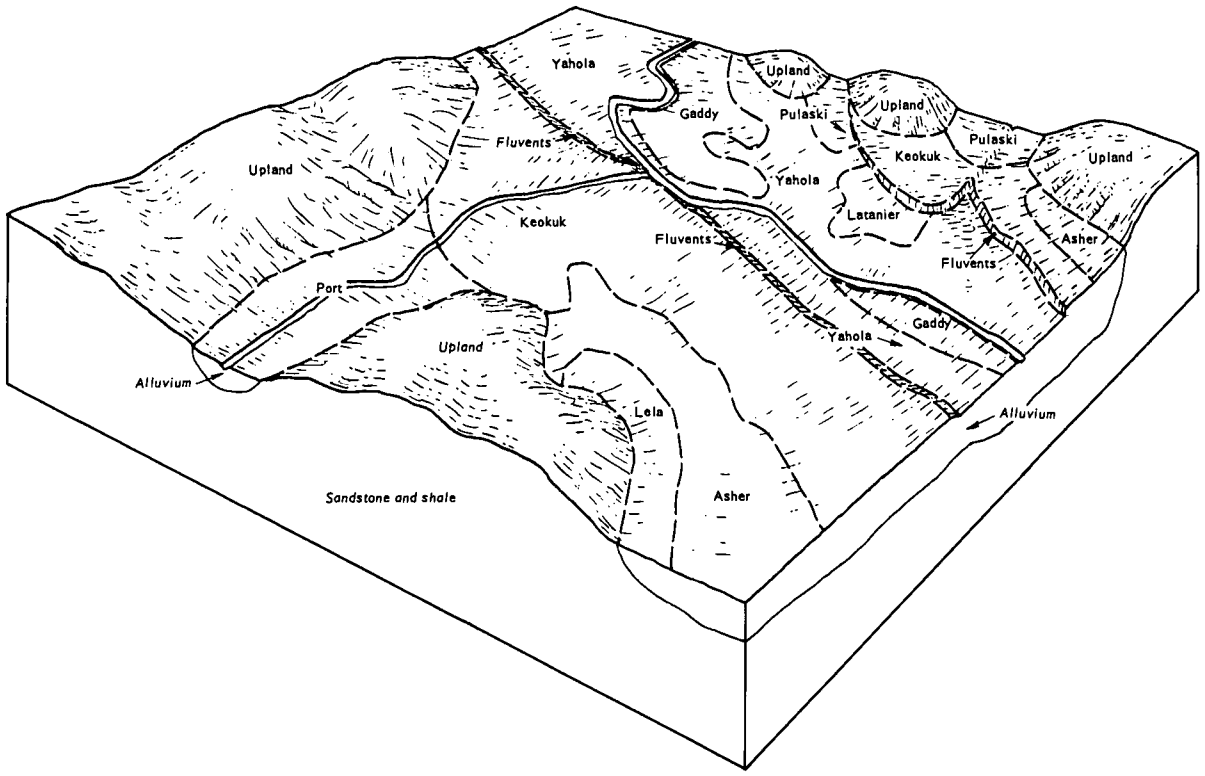

Figure 1.—Pattern of soils on flood plains between upland areas in the Port-Yahola-Keokuk association.

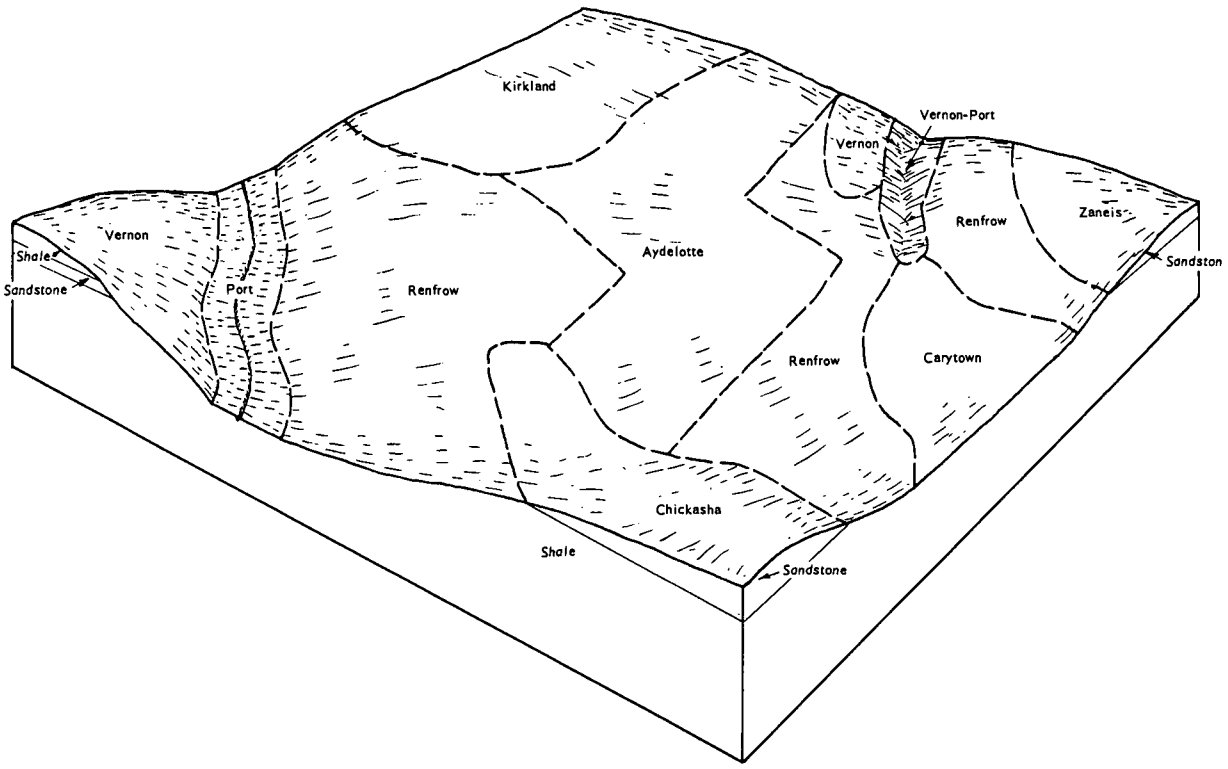

Figure 2.—Pattern of soils in the Aydelotte-Renfrow-Zaneis association.

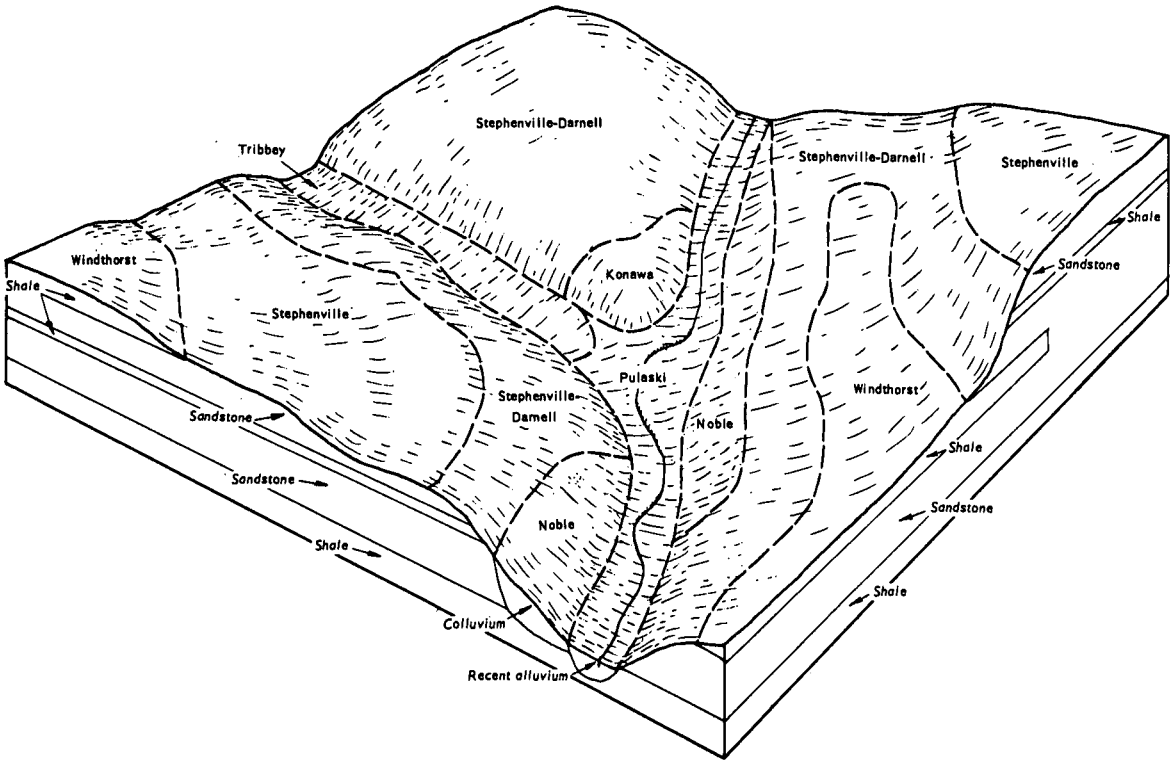

Figure 3.—Pattern of soils in the Stephenville-Darnell association.

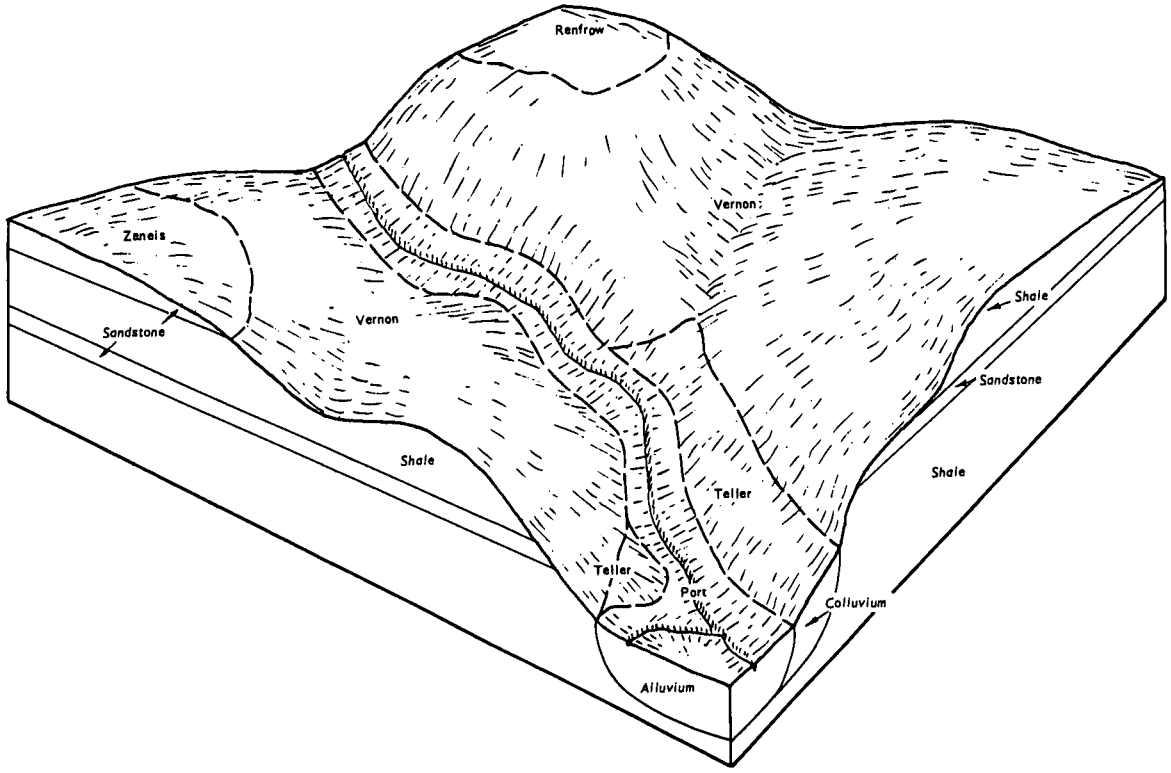

Figure 4.—Pattern of soils in the Vernon association.

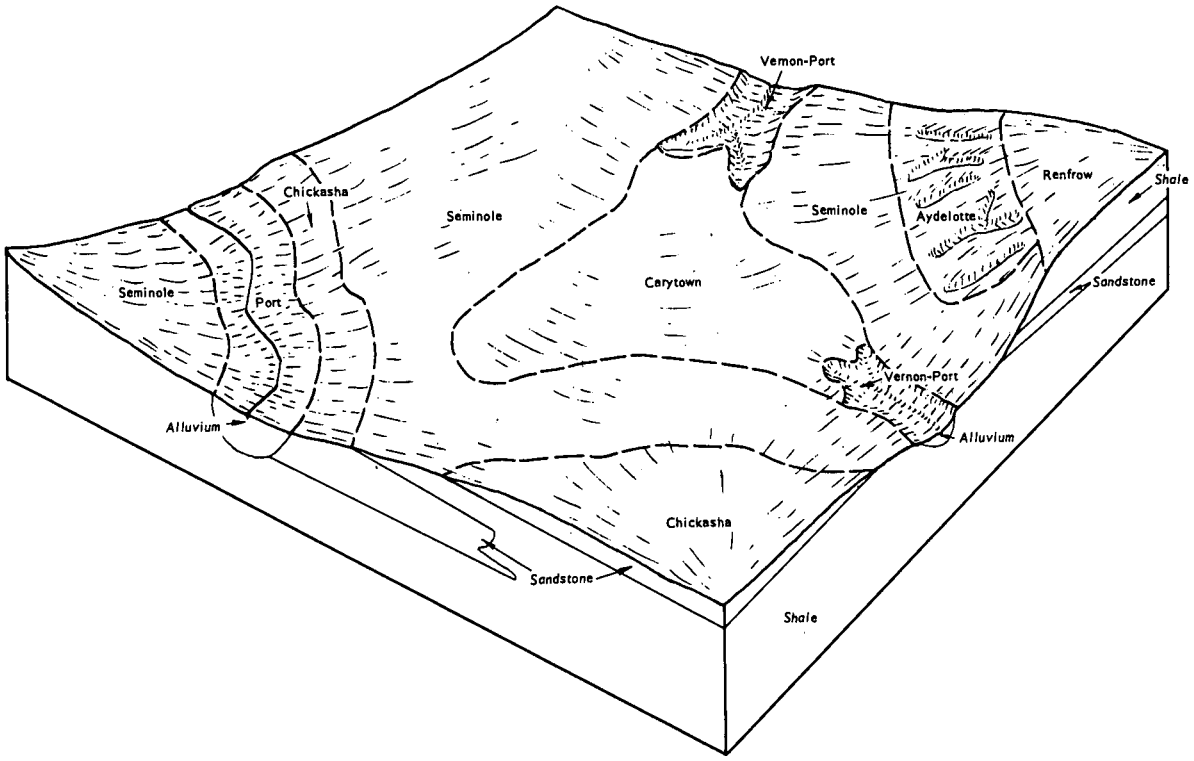

Figure 5.—Pattern of soils in the Seminole-Chickasha-Aydelotte association.

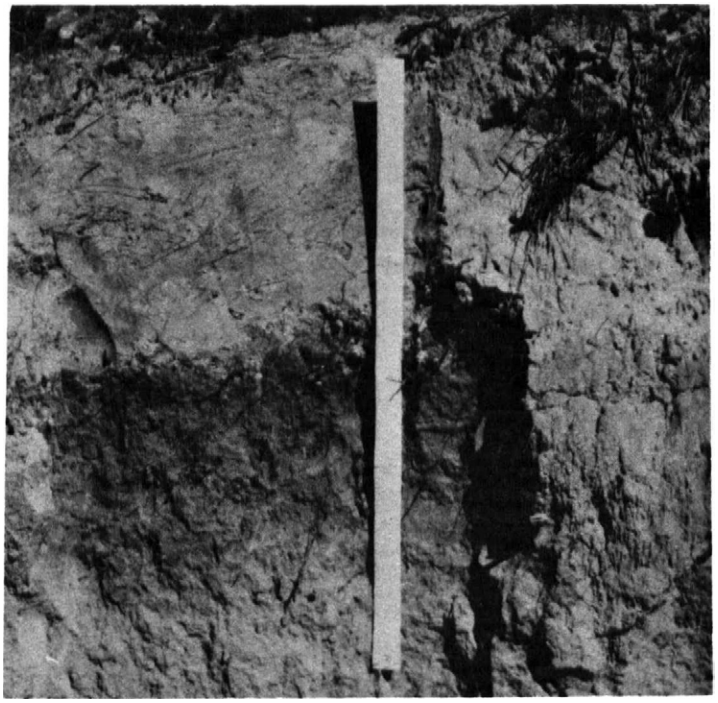

Figure 6.—Profile of Dougherty loamy fine sand, 3 to 8 percent slopes.

Figure 7.—Gully on Konawa fine sandy loam, 3 to 8 percent slopes, severely eroded.

Figure 8.—Profile of Darnell fine sandy loam.

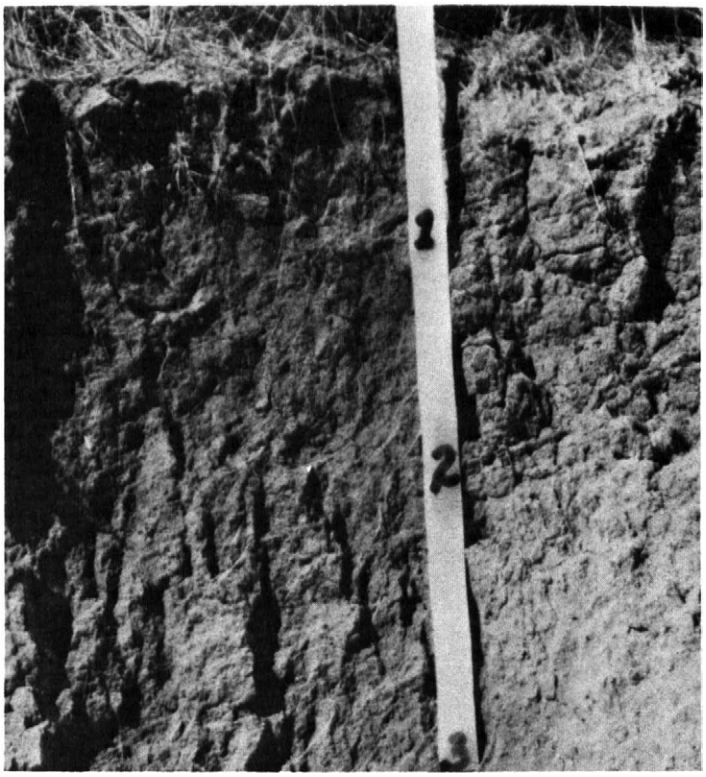

Figure 9.—Profile of Teller fine sandy loam, 3 to 5 percent slopes.

Figure 10.—Peanuts on Zaneis loam, 1 to 3 percent slopes.

A P P E N D I X

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

[Data for Shawnee, Pottawatomie County. Temperature 1942-71; precipitation, 1941-70]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Average maximum	Average minimum	Average	One year in 10 will have-		Days with snow cover of 1 inch or more	Average depth of snow on days with snow cover
						Less than--	More than--		
	F	F	F	F	In	In	In	In	In
January----	51	27	73	5	1.4	0.2	3.0	2	2
February---	56	30	76	13	1.8	0.5	3.5	2	2
March------	63	37	84	18	2.4	0.7	4.5	0	3
April------	74	50	89	32	4.5	1.5	8.3	0	0
May--------	80	58	91	42	6.2	2.5	10.5	0	0
June-------	89	66	97	53	4.6	1.1	9.2	0	0
July-------	94	70	102	60	3.3	0.8	6.7	0	0
August-----	94	68	103	57	2.9	0.7	5.8	0	0
September--	87	60	99	44	3.9	0.5	8.7	0	0
October----	77	50	90	32	3.1	0.3	7.5	0	0
November---	64	38	79	20	2.0	0.1	4.5	0	0
December---	53	30	73	11	1.6	0.3	3.3	1	2
Year------	74	49	105	2	37.7	25.4	51.0	2	2

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Data are from Shawnee, Pottawatomie County, 1921-68]

Probability	Minimum temperature				
	16° F	20° F	24° F	28° F	32° F
Spring:					
1 year in 10 later than---	Mar. 11	Mar. 25	Apr. 1	Apr. 11	Apr. 17
2 years in 10 later than---	Mar. 2	Mar. 18	Mar. 26	Apr. 6	Apr. 12
5 years in 10 later than---	Feb. 13	Mar. 5	Mar. 15	Mar. 26	Apr. 3
Fall:					
1 year in 10 earlier than-	Nov. 23	Nov. 13	Nov. 3	Oct. 24	Oct. 17
2 years in 10 earlier than-	Nov. 30	Nov. 19	Nov. 9	Oct. 29	Oct. 21
5 years in 10 earlier than-	Dec. 16	Dec. 2	Nov. 22	Nov. 10	Oct. 31

TABLE 3.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Asher silty clay loam	4,490	0.9
2	Aydelotte loam, 2 to 5 percent slopes	11,640	2.3
3	Aydelotte clay loam, 3 to 6 percent slopes, severely eroded	18,850	3.7
4	Borrow Pits	270	0.1
5	Carytown silt loam, 0 to 1 percent slopes	1,290	0.3
6	Chickasha loam, 1 to 3 percent slopes	2,850	0.6
7	Chickasha loam, 3 to 5 percent slopes	9,195	1.8
8	Chickasha and Zaneis soils, 1 to 8 percent slopes, severely eroded	17,270	3.4
9	Chigley complex, 3 to 12 percent slopes	5,195	1.0
10	Dougherty loamy fine sand, 0 to 3 percent slopes	825	0.2
11	Dougherty loamy fine sand, 3 to 8 percent slopes	2,450	0.5
12	Eufaula fine sand, 0 to 3 percent slopes	2,600	0.5
13	Eufaula fine sand, 3 to 12 percent slopes	8,845	1.7
14	Fluvents, 8 to 15 percent slopes	1,335	0.3
15	Gaddy loamy fine sand	6,720	1.3
16	Galey fine sandy loam, 0 to 2 percent slopes	1,810	0.4
17	Gracemont fine sandy loam	4,280	0.8
18	Gracemore fine sand	2,065	0.4
19	Gravel pits	755	0.1
20	Harjo clay	3,270	0.6
21	Keokuk silt loam	10,450	2.0
22	Kirkland silt loam, 0 to 1 percent slopes	1,135	0.2
23	Konawa loamy fine sand, 3 to 8 percent slopes	7,315	1.4
24	Konawa fine sandy loam, 0 to 3 percent slopes	4,060	0.8
25	Konawa fine sandy loam, 3 to 5 percent slopes	8,350	1.6
26	Konawa fine sandy loam, 3 to 8 percent slopes, severely eroded	14,795	2.9
27	Latanier silty clay loam	1,875	0.4
28	Lela silty clay	1,860	0.4
29	Miller clay loam	3,690	0.7
30	Noble fine sandy loam, 3 to 8 percent slopes	810	0.2
31	Norge loam, 1 to 3 percent slopes	1,330	0.3
32	Norge loam, 3 to 5 percent slopes	1,130	0.2
33	Port loam	23,990	4.7
34	Port soils	6,080	1.2
35	Pulaski fine sandy loam	16,705	3.2
36	Renfrow silt loam, 1 to 3 percent slopes	7,750	1.5
37	Renfrow silt loam, 3 to 5 percent slopes	6,145	1.2
38	Sayers complex	1,670	0.3
39	Seminole loam, 0 to 2 percent slopes	1,760	0.3
40	Seminole loam, 2 to 5 percent slopes	6,420	1.2
41	Stephenville fine sandy loam, 1 to 3 percent slopes	1,115	0.2
42	Stephenville fine sandy loam, 3 to 5 percent slopes	18,000	3.5
43	Stephenville-Darnell complex, 5 to 12 percent slopes	60,739	11.8
44	Teller fine sandy loam, 3 to 5 percent slopes	3,325	0.6
45	Tribbey fine sandy loam	3,530	0.7
46	Vanoss loam, 0 to 1 percent slopes	1,605	0.3
47	Vanoss loam, 1 to 3 percent slopes	2,485	0.5
48	Vernon clay loam, 3 to 5 percent slopes	4,015	0.8
49	Vernon clay, 5 to 12 percent slopes	39,665	7.7
50	Vernon-Port complex	20,760	4.0
51	Weatherford fine sandy loam, 1 to 3 percent slopes	4,060	0.8
52	Weatherford fine sandy loam, 3 to 5 percent slopes	24,525	4.8
53	Weatherford and Stephenville soils, 3 to 8 percent slopes, severely eroded	59,310	11.5
54	Windthorst fine sandy loam, 1 to 5 percent slopes	5,295	1.0
55	Yahola fine sandy loam	12,325	2.4
56	Zaneis loam, 1 to 3 percent slopes	2,600	0.5
57	Zaneis loam, 3 to 5 percent slopes	11,545	2.2
	Water	5,696	1.1
	Total	513,920	100.0

TABLE 4.--YIELDS OF PRINCIPAL PASTURE AND HAY PLANTS

Pasture and hayland suitability group	Plants	Animal unit months[1] per acre												Total	
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	A.U.M.	Hay Ton
Group 1A: Deep, nearly level, loamy and clayey soils with a clayey subsoil; on flood plains. Very slowly permeable, moderately well drained and somewhat poorly drained.	Improved bermudagrass	--	--	--	--	1.7	1.7	1.3	0.8	0.8	0.7	--	--	7.0	2.8
	Tall fescue	--	--	0.8	1.1	0.9	0.8	--	--	0.8	1.1	1.0	--	6.5	2.6
	King Ranch bluestem	--	--	--	--	1.4	1.4	0.7	0.6	0.8	0.6	--	--	5.5	2.2
Group 1B: Deep, nearly level, clayey soils with a clayey subsoil; on flood plains. Very slowly permeable, poorly drained, and frequently flooded.	Improved bermudagrass	--	--	--	--	0.9	0.9	0.7	0.5	0.6	0.4	--	--	4.0	1.6
	Tall fescue	--	--	0.5	0.7	0.5	0.5	--	--	0.5	0.7	0.6	--	4.0	1.6
Group 2A: Deep, nearly level through very gently sloping, loamy soils with a loamy subsoil; on flood plains. Moderately rapidly permeable through slowly permeable, well drained and moderately well drained.	Improved bermudagrass	--	--	--	--	1.8	1.8	1.3	0.9	0.9	0.8	--	--	7.5	3.0
	Improved lovegrass	--	--	--	1.3	1.8	1.5	0.9	0.8	0.9	0.3	--	--	7.5	3.0
	Tall fescue	--	--	1.0	1.2	1.0	1.0	--	--	1.0	1.2	1.1	--	7.5	2.0
Group 2B: Deep, nearly level through very gently sloping, loamy soils with a loamy subsoil; on flood plains. Moderately rapidly permeable, somewhat poorly drained.	Tall fescue	--	--	1.0	1.4	1.0	1.0	--	--	1.0	1.4	1.2	--	8.0	3.2
	Improved bermudagrass	--	--	--	--	1.8	1.8	1.4	1.0	1.2	0.8	--	--	8.0	3.2
Group 3A: Deep, nearly level through very gently sloping, sandy soils with a sandy subsoil; on flood plains. Moderately rapidly permeable, somewhat excessively drained.	Improved bermudagrass	--	--	--	--	1.5	1.5	1.0	0.7	0.8	0.5	--	--	6.0	2.4
	Improved lovegrass	--	--	--	1.0	1.6	1.3	0.8	0.7	0.8	0.3	--	--	6.5	2.6
Group 3B: Deep, nearly level, through very gently sloping, sandy soils with a sandy subsoil; on flood plains. Moderately rapidly permeable, somewhat poorly drained.	Improved bermudagrass	--	--	--	--	1.7	1.7	1.3	0.8	0.8	0.7	--	--	7.0	2.8
	Tall fescue	--	--	0.8	1.1	0.9	0.8	--	--	0.8	1.1	1.0	--	7.0	2.6
Group 7A: Deep, gently sloping, clayey and loamy soils with a clayey subsoil; on uplands. Very slowly permeable, well drained.	King Ranch bluestem	--	--	--	--	0.9	0.9	0.4	0.4	0.5	0.4	--	--	3.5	1.4
	Improved bermudagrass	--	--	--	--	0.6	0.6	0.5	0.3	0.3	0.2	--	--	2.5	1.0
Group 8A: Deep and moderately deep, nearly level through sloping, loamy soils with a loamy or clayey subsoil; on uplands. Moderately rapidly permeable through slowly permeable, well drained and moderately well drained.	Improved bermudagrass	--	--	--	--	1.5	1.5	1.0	0.7	0.8	0.5	--	--	6.0	2.4
	Improved lovegrass	--	--	--	0.9	1.5	1.2	0.7	0.6	0.8	0.3	--	--	6.0	2.4
	King Ranch bluestem	--	--	--	--	1.3	1.3	0.6	0.5	0.7	0.6	--	--	5.0	2.0

See footnotes at end of table.

TABLE 4.--YIELDS OF PRINCIPAL PASTURE AND HAY PLANTS--Continued

Pasture and hayland suitability group	Plants	Animal unit months[1] per acre												Total	
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	A.U.M.	Hay Ton
Group 8C:															
Deep, nearly level through sloping, loamy soils with a clayey or loamy subsoil; on uplands. Very slowly permeable, well drained.	King Ranch bluestem	--	--	--	--	1.2	1.2	0.7	0.5	0.8	0.6	--	--	5.0	2.0
	Improved bermudagrass	--	--	--	--	1.1	1.1	0.8	0.5	0.6	0.4	--	--	4.5	1.8
Group 8D:															
Deep, nearly level, loamy soils with a clayey subsoil high in sodium; on uplands. Very slowly permeable, poorly drained.	Improved bermudagrass	--	--	--	--	1.2	1.2	0.9	0.6	0.7	0.4	--	--	5.0	2.0
Group 8F:															
Deep and moderately deep, very gently sloping through sloping, severely eroded, loamy soils with a loamy or clayey subsoil; on uplands. Moderately permeable through very slowly permeable, well drained.	King Ranch bluestem	--	--	--	--	1.0	1.0	0.5	0.4	0.6	0.5	--	--	4.0	1.6
	Improved lovegrass	--	--	--	0.6	1.0	0.8	0.5	0.4	0.5	0.2	--	--	4.0	1.6
	Improved bermudagrass	--	--	--	--	1.0	1.0	0.7	0.5	0.5	0.3	--	--	4.0	1.6
Group 9A:															
Deep, nearly level through sloping, sandy soils with a loamy subsoil; on uplands. Moderately permeable, well drained.	Improved lovegrass	--	--	--	0.9	1.5	1.2	0.7	0.6	0.8	0.3	--	--	6.0	2.4
	Improved bermudagrass	--	--	--	--	1.3	1.3	0.9	0.7	0.8	0.5	--	--	5.5	2.2
Group 9B:															
Deep, nearly level through strongly sloping, sandy soils with a sandy subsoil; on uplands. Rapidly permeable, somewhat excessively drained.	Improved bermudagrass	--	--	--	--	1.0	1.0	0.7	0.5	0.5	0.3	--	--	4.0	1.6
	Improved lovegrass	--	--	--	0.7	1.1	0.9	0.5	0.5	0.6	0.2	--	--	4.5	1.8
Group 14A:															
Shallow, sloping through strongly sloping, loamy soils with a loamy subsoil; on uplands. Moderately rapidly permeable, well drained to excessively drained.	Improved bermudagrass	--	--	--	--	0.7	0.7	0.5	0.4	0.4	0.3	--	--	3.0	1.2
	Improved lovegrass	--	--	--	0.5	0.9	0.7	0.4	0.4	0.5	0.1	--	--	3.5	1.4

[1]Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[All yields were estimated for a high level of management in 1974. Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Wheat	Alfalfa hay	Grain sorghum	Peanuts	Soybeans	Improved bermudagrass
	Bu	Ton	Bu	Lb	Bu	AUM[1]
Asher:						
1	35	4.5	55	---	30	7.5
Aydelotte:						
2	20	---	20	---	---	2.5
3	---	---	---	---	---	2.0
Borrow Pits:						
4	---	---	---	---	---	---
Carytown:						
5	30	2.5	40	---	25	5.0
Chickasha:						
6	30	2.5	40	1,500	30	5.5
7	25	---	35	1,300	25	5.0
8[2]	---	---	---	---	---	4.0
Chigley:						
9[2]	---	---	---	---	---	3.5
Dougherty:						
10	20	---	30	1,100	---	5.0
11	15	---	25	1,100	---	5.0
Eufaula:						
12	15	---	25	1,100	---	4.0
13	---	---	---	---	---	3.5
Fluvents:						
14	---	---	---	---	---	6.0
Gaddy:						
15	20	3.0	30	1,300	20	6.0
Galey:						
16	30	3.0	50	1,500	30	7.0
Gracemont:						
17	---	---	---	---	---	8.0
Gracemore:						
18	---	---	---	---	---	7.0
Gravel Pits:						
19	---	---	---	---	---	---
Harjo:						
20	---	---	---	---	---	4.0
Keokuk:						
21	35	4.5	65	1,800	30	8.0
Kirkland:						
22	30	2.5	40	---	25	5.5
Konawa:						
23	20	---	30	---	---	5.5
24	30	3.0	50	1,600	30	7.0

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Wheat	Alfalfa hay	Grain sorghum	Peanuts	Soybeans	Improved bermudagrass
	Bu	Ton	Bu	Lb	Bu	AUM[1]
Konawa:						
25	25	---	40	1,300	25	6.5
26	---	---	---	---	---	5.0
Latanier:						
27	35	3.5	65	---	30	8.0
Lela:						
28	30	3.5	55	---	30	6.5
Miller:						
29	35	3.5	60	---	30	6.5
Noble:						
30	20	---	35	---	---	5.5
Norge:						
31	30	3.0	50	1,500	30	7.0
32	25	---	45	1,300	25	6.5
Port:						
33	35	4.5	60	1,800	30	8.0
[2]34	---	---	---	---	---	8.0
Pulaski:						
35	30	4.0	50	1,600	30	7.5
Renfrow:						
36	25	---	30	---	25	3.0
37	20	---	25	---	20	2.5
Sayers:						
[2]38	20	2.5	25	1,100	20	5.5
Seminole:						
39	30	---	40	1,500	30	6.0
40	25	---	35	1,300	25	5.5
Stephenville:						
41	25	---	40	1,350	25	6.0
42	20	---	35	1,150	20	5.5
[2]43	---	---	---	---	---	4.5
Teller:						
44	25	---	40	1,300	25	6.5
Tribbey:						
45	---	---	---	---	---	8.0
Vanoss:						
46	35	3.5	55	1,700	30	7.5
47	30	3.0	50	1,500	30	7.0
Vernon:						
48	15	---	20	---	15	2.0
49	---	---	---	---	---	1.5
[2]50	---	---	---	---	---	2.0

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Wheat	Alfalfa hay	Grain sorghum	Peanuts	Soybeans	Improved bermudagrass
	Bu	Ton	Bu	Lb	Bu	AUM[1]
Weatherford:						
51	30	---	45	1,400	30	6.0
52	25	---	40	1.200	25	4.0
[2]53	---	---	---	---	---	4.0
Windthorst:						
54	20	---	40	1,100	20	4.5
Yahola:						
55	30	4.0	50	1,600	30	7.5
Zaneis:						
56	30	2.6	40	1,400	30	6.5
57	25	---	35	1,200	25	6.0

[1]Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one steer; five hogs; or five sheep) for 1 month without damage to the pasture.

[2]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 6.--RANGE PRODUCTIVITY AND COMPOSITION

[Soils not in range sites can be used for grazing if grass cover is established]

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lbs/acre		Pct
Asher:					
1	Loamy Bottomland	Favorable	8,000	Big bluestem	25
		Normal	5,600	Indiangrass	15
		Unfavorable	4,000	Switchgrass	15
				Little bluestem	10
				Eastern gamagrass	5
				Tall dropseed	5
				Florida paspalum	5
				Canada wildrye	5
				Maximillan sunflower	5
				Eastern cottonwood	5
				Other trees	5
Aydelotte:					
2	Claypan Prairie	Favorable	4,000	Little bluestem	25
		Normal	2,800	Big bluestem	20
		Unfavorable	2,000	Switchgrass	15
				Indiangrass	10
				Side-oats grama	5
				Blue grama	5
				Buffalograss	5
				Leadplant	5
				Goldenrod	5
				Coralberry	5
3	Eroded Clay	Favorable	2,000	Side-oats grama	30
		Normal	1,400	Blue grama	15
		Unfavorable	1,000	Buffalograss	15
				Little bluestem	10
				Prairieclover	3
				Dalea species	2
				Maximilian sunflower	2
				Other perennial grasses	15
				Other perennial forbs	8
Borrow Pits:					
4	No range site.				
Carytown:					
5	Claypan Prairie	Favorable	4,000	Little bluesteam	25
		Normal	2,800	Big bluestem	20
		Unfavorable	2,000	Switchgrass	15
				Indiangrass	10
				Side-oats grama	5
				Blue grama	5
				Buffalograss	5
				Goldenrod	5
				Coralberry	5
				Leadplant	3
				Bundleflower	2
Chickasha:					
6, 7	Loamy Prairie	Favorable	5,500	Little bluestem	25
		Normal	3,600	Big bluestem	20
		Unfavorable	2,500	Indiangrass	10
				Switchgrass	10
				Canada wildrye	5
				Side-oats grama	5
				Blue grama	5
				Tall dropseed	5
				Other perennial grasses	15

See footnotes at end of table.

TABLE 6.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lbs/acre		Pct
Chickasha: [1]8:					
Chickasha part---	Eroded Prairie----------	Favorable	3,500	Little bluestem----------	35
		Normal	2,600	Big bluestem----------	10
		Unfavorable	1,800	Side-oats grama----------	10
				Tall dropseed----------	10
				Indiangrass----------	5
				Switchgrass----------	5
				Blue grama----------	5
				Other perennial grasses-------	20
Zaneis part------	Eroded Prairie----------	Favorable	3,500	Little bluestem----------	35
		Normal	2,600	Big bluestem----------	15
		Unfavorable	2,500	Side-oats grams----------	10
				Tall dropseed----------	5
				Indiangrass----------	5
				Switchgrass----------	5
				Blue grama----------	5
				Other perennial grasses-------	20
Chigley: [1]9----------	Sandy Savannah----------	Favorable	5,000	Little bluestem----------	25
		Normal	3,500	Big bluestem----------	20
		Unfavorable	2,500	Indiangrass----------	5
				Switchgrass----------	5
				Sand lovegrass----------	5
				Scribner panicum----------	5
				Purpletop----------	5
				Tall dropseed----------	5
				Perennial sunflower----------	5
				Goldenrod----------	5
				Trees----------	15

See footnotes at end of table.

TABLE 6.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lbs/ acre		Pct
Dougherty:					
10, 11	Deep Sand Savannah	Favorable	4,000	Little bluestem	25
		Normal	2,800	Big bluestem	10
		Unfavorable	2,000	Sand bluestem	10
				Indiangrass	5
				Switchgrass	5
				Purpletop	5
				Arrowfeather threeawn	5
				Scribner panicum	5
				Side-oats grama	5
				Perennial lespedezas	5
				Trees	20
Eufaula:					
12, 13	Deep Sand Savannah	Favorable	4,000	Little bluestem	25
		Normal	2,800	Big bluestem	10
		Unfavorable	2,000	Sand bluestem	10
				Indiangrass	5
				Switchgrass	5
				Purpletop	5
				Arrowfeather threeawn	5
				Scribner panicum	5
				Side-oats grama	5
				Perennial lespedezas	5
				Trees	20
Fluvents:					
14	Loamy Bottomland	Favorable	6,000	Big bluestem	25
		Normal	4,200	Indiangrass	15
		Unfavorable	3,000	Switchgrass	15
				Little bluestem	10
				Eastern gamagrass	5
				Tall dropseed	5
				Beaked panicum	5
				Compassplant	5
				Sedges	5
				Heath aster	5
				Trees	5
Gaddy:					
15	Sandy Bottomland	Favorable	3,800	Switchgrass	30
		Normal	2,700	Sand bluestem	15
		Unfavorable	2,000	Indiangrass	15
				Little bluestem	5
				Texas bluegrass	5
				Beaked panicum	5
				Purpletop	5
				Goldenrod	5
				Heath aster	5
				Maximilian sunflower	5
				Trees	5
Galey:					
16	Sandy Savannah	Favorable	4,500	Big bluestem	20
		Normal	3,800	Little bluestem	25
		Unfavorable	2,500	Indiangrass	5
				Switchgrass	5
				Purpletop	5
				Scribner panicum	5
				Purple lovegrass	5
				Jointtail grass	5
				Splitbeard bluestem	5
				Silver bluestem	5
				Trees	15

See footnotes at end of table.

TABLE 6.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lbs/ acre		Pct
Gracemont: 17	Subirrigated	Favorable	9,000	Switchgrass	25
		Normal	7,800	Big bluestem	20
		Unfavorable	7,000	Indiangrass	10
				Eastern gamagrass	10
				Canada wildrye	5
				Maximilian sunflower	5
				Other perennial grasses	20
				Trees	5
Gracemore: 18	Subirrigated	Favorable	9,000	Switchgrass	25
		Normal	7,500	Big bluestem	20
		Unfavorable	7,000	Indiangrass	10
				Eastern gamagrass	10
				Beaked panicum	10
				Canada wildrye	5
				Scribner panicum	5
				Purpletop	5
				Maximilian sunflower	5
				Trees	5
Gravel Pits: 19	No range site.				
Harjo: 20	Wetland	Favorable	4,500	Bushy bluestem	20
		Normal	3,600	Willow	15
		Unfavorable	3,000	Eastern cottonwood	15
				Switchgrass	10
				Indiangrass	5
				Big bluestem	5
				Little bluestem	5
				Beaked panicum	5
				Sedges	5
				Cattail	5
				Other trees	10
Keokuk: 21	Loamy Bottomland	Favorable	4,000	Little bluestem	25
		Normal	6,100	Indiangrass	15
		Unfavorable	4,500	Switchgrass	15
				Little bluestem	10
				Eastern gamagrass	5
				Tall dropseed	5
				Florida paspalum	5
				Canada wildrye	5
				Maximilian sunflower	5
				Eastern cottonwood	5
				Other trees	5
Kirkland: 22	Claypan Prairie	Favorable	4,000	Little bluestem	25
		Normal	2,800	Big bluestem	20
		Unfavorable	2,000	Switchgrass	15
				Indiangrass	10
				Side-oats grama	5
				Blue grama	5
				Buffalograss	5
				Goldenrod	5
				Coralberry	5
				Leadplant	3
				Bundleflower	2

See footnotes at end of table.

TABLE 6.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lbs/ acre		Pct
Konawa:					
23	Deep Sand Savannah	Favorable	3,800	Little bluestem	25
		Normal	2,700	Big bluestem	20
		Unfavorable	1,800	Indiangrass	5
				Switchgrass	5
				Purpletop	5
				Scribner panicum	5
				Arrowfeather threeawn	5
				Side-oats grama	5
				Perennial lespedezas	5
				Trees	20
24, 25	Sandy Savannah	Favorable	4,500	Little bluestem	25
		Normal	3,800	Big bluestem	20
		Unfavorable	2,500	Indiangrass	5
				Switchgrass	5
				Purpletop	5
				Scribner panicum	5
				Other perennial grasses	20
				Trees	15
26	Eroded Sandy Savannah	Favorable	2,500	Little bluestem	30
		Normal	1,600	Indiangrass	10
		Unfavorable	1,250	Big bluestem	5
				Switchgrass	5
				Purpletop	5
				Scribner panicum	5
				Other perennial grasses	25
				Trees	15
Latanier:					
27	Heavy Bottomland	Favorable	5,500	Big bluestem	25
		Normal	3,700	Switchgrass	15
		Unfavorable	2,500	Indiangrass	15
				Prairie cordgrass	10
				Western wheatgrass	5
				Tall dropseed	5
				Perennial sunflower	5
				Goldenrod	5
				Sedges	5
				Trees	10
Lela:					
28	Heavy Bottomland	Favorable	5,500	Big bluestem	25
		Normal	3,700	Switchgrass	15
		Unfavorable	2,500	Indiangrass	15
				Prairie cordgrass	10
				Western wheatgrass	5
				Tall dropseed	5
				Perennial sunflower	5
				Goldenrod	5
				Sedges	5
				Trees	10
Miller:					
29	Heavy Bottomland	Favorable	5,000	Big bluestem	25
		Normal	3,200	Switchgrass	15
		Unfavorable	2,000	Indiangrass	15
				Prairie cordgrass	10
				Western wheatgrass	5
				Tall dropseed	5
				Perennial sunflower	5
				Goldenrod	5
				Sedges	5
				Trees	10

See footnotes at end of table.

TABLE 6.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lbs/ acre		Pct
Noble:					
30	Sandy Savannah	Favorable	4,500	Little bluestem	25
		Normal	3,300	Big bluestem	20
		Unfavorable	2,500	Indiangrass	5
				Switchgrass	5
				Perennial sunflower	5
				Other perennial grasses	20
				Trees	10
				Other shrubs	5
				Other perennial forbs	5
Norge:					
31, 32	Loamy Prairie	Favorable	5,000	Little bluestem	25
		Normal	3,500	Big bluestem	20
		Unfavorable	2,500	Indiangrass	10
				Switchgrass	10
				Canada wildrye	5
				Side-oats grama	5
				Blue grama	5
				Tall dropseed	5
				Prairieclover	5
				Dotted gayfeather	5
				Trees	5
Port:					
33, [1]34	Loamy Bottomland	Favorable	8,500	Big bluestem	25
		Normal	6,100	Indiangrass	15
		Unfavorable	4,500	Switchgrass	15
				Little bluestem	10
				Eastern gamagrass	5
				Tall dropseed	5
				Beaked panicum	5
				Compassplant	5
				Heath aster	5
				Sedges	5
				Trees	5
Pulaski:					
35	Loamy Bottomland	Favorable	8,500	Big bluestem	25
		Normal	6,100	Indiangrass	15
		Unfavorable	4,500	Switchgrass	15
				Little bluestem	10
				Eastern gamagrass	5
				Tall dropseed	5
				Beaked panicum	5
				Compassplant	5
				Sedges	5
				Heath aster	5
				Trees	5
Renfrow:					
36, 37	Claypan Prairie	Favorable	4,000	Little bluestem	25
		Normal	2,800	Big bluestem	20
		Unfavorable	2,000	Switchgrass	15
				Indiangrass	10
				Side-oats grama	5
				Blue grama	5
				Buffalograss	5
				Leadplant	5
				Goldenrod	5
				Coralberry	5

See footnotes at end of table.

TABLE 6.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lbs/ acre		Pct
Sayers:					
[1]38	Sandy Bottomland	Favorable	3,800	Switchgrass	30
		Normal	2,700	Sand bluestem	15
		Unfavorable	2,000	Indiangrass	15
				Little bluestem	5
				Texas bluegrass	5
				Beaked panicum	5
				Purpletop	5
				Goldenrod	5
				Heath aster	5
				Maximilian sunflower	5
				Trees	5
Seminole:					
39, 40	Loamy Prairie	Favorable	5,000	Little bluestem	25
		Normal	3,500	Big bluestem	20
		Unfavorable	2,500	Indiangrass	10
				Switchgrass	10
				Canada wildrye	5
				Side-oats grama	5
				Blue grama	5
				Tall dropseed	5
				Perennial lespedezas	5
				Dotted gayfeather	5
				Shrubs	5
Stephenville:					
41, 42	Sandy Savannah	Favorable	4,500	Little bluestem	25
		Normal	3,300	Big bluestem	20
		Unfavorable	2,500	Indiangrass	5
				Switchgrass	5
				Sand lovegrass	5
				Scribner panicum	5
				Purpletop	5
				Perennial sunflower	5
				Goldenrod	5
				Trees	15
				Other perennial grasses	5
[1]43:					
Stephenville part	Sandy Savannah	Favorable	4,500	Little bluestem	25
		Normal	3,300	Big bluestem	20
		Unfavorable	2,500	Indiangrass	5
				Switchgrass	5
				Sand lovegrass	5
				Scribner panicum	5
				Purpletop	5
				Perennial sunflower	5
				Goldenrod	5
				Trees	15
				Other pernnial grasses	5
Darnell part	Shallow Savannah	Favorable	3,200	Little bluestem	30
		Normal	2,100	Big bluestem	20
		Unfavorable	1,400	Indiangrass	5
				Switchgrass	5
				Side-oats grama	5
				Purpletop	5
				Scribner panicum	5
				Tall dropseed	5
				Hairy sunflower	5
				Trees	10
				Shrubs	5

See footnotes at end of table.

TABLE 6.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production			Common plant name	Composition
		Kind of year	Dry weight			
			Lbs/ acre			Pct
Teller:						
44	Loamy Prairie	Favorable	6,000		Little bluestem	25
		Normal	4,200		Big bluestem	20
		Unfavorable	3,000		Indiangrass	10
					Switchgrass	10
					Canada wildrye	5
					Side-oats grama	5
					Blue grama	5
					Tall dropseed	5
					Dotted gayfeather	5
					Slender lespedeza	3
					Roundhead lespedeza	2
					Trees	5
Tribbey:						
45	Wetland	Favorable	5,000		Switchgrass	25
		Normal	3,600		Bushy bluestem	25
		Unfavorable	3,000		Sedges	10
					Eastern gamagrass	5
					Indiangrass	5
					Big bluestem	5
					Beaked panicum	5
					Rushes	5
					Other shrubs	10
					Trees	5
Vanoss:						
46, 47	Loamy Prairie	Favorable	5,000		Little bluestem	25
		Normal	3,300		Big bluestem	20
		Unfavorable	2,200		Indiangrass	10
					Switchgrass	10
					Canada wildrye	5
					Side-oats grama	5
					Blue grama	5
					Tall dropseed	5
					Dotted gayfeather	5
					Slender lespedeza	3
					Roundhead lespedeza	2
					Trees	5
Vernon:						
48, 49	Red Clay Prairie	Favorable	1,750		Side-oats grama	25
		Normal	1,350		Buffalograss	15
		Unfavorable	900		Tobosa	15
					Vine-mesquite	5
					Hairy grama	5
					Silver bluestem	5
					Arizona cottontop	5
					Blue grama	5
					Other perennial grasses	10
					Other perennial forbs	5
					Other shrubs	5
[1]50:						
Vernon part	Red Clay Prairie	Favorable	1,750		Side-oats grama	25
		Normal	1,350		Buffalograss	15
		Unfavorable	900		Tobosa	15
					Vine-mesquite	5
					Hairy grama	5
					Silver bluestem	5
					Arizona cottontop	5
					Blue grama	5
					Other perennial grasses	10
					Other perennial forbs	5
					Other shrubs	5

See footnotes at end of table.

TABLE 6.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lbs/ acre		Pct
Vernon:					
[1]50:					
Port part	Loamy Bottomland	Favorable	8,500	Big bluestem	25
		Normal	6,100	Indiangrass	15
		Unfavorable	4,500	Switchgrass	15
				Little bluestem	10
				Eastern gamagrass	5
				Tall dropseed	5
				Beaked panicum	5
				Compassplant	5
				Heath aster	5
				Sedges	5
				Trees	5
Weatherford:					
51, 52	Sandy Savannah	Favorable	4,600	Little bluestem	25
		Normal	3,300	Big bluestem	20
		Unfavorable	2,500	Indiangrass	5
				Switchgrass	5
				Sand lovegrass	5
				Scribner panicum	5
				Purpletop	5
				Perennial sunflower	5
				Goldenrod	5
				Trees	15
				Other perennial grasses	5
[1]53	Eroded Sandy Savannah	Favorable	2,200	Little bluestem	30
		Normal	1,500	Indiangrass	10
		Unfavorable	1,100	Big bluestem	5
				Switchgrass	5
				Purpletop	5
				Tick clover	5
				Other perennial grasses	20
				Trees	10
				Other perennial forbs	10
Windthorst:					
54	Sandy Savannah	Favorable	4,500	Little bluestem	25
		Normal	3,300	Big bluestem	20
		Unfavorable	2,500	Indiangrass	5
				Switchgrass	5
				Sand lovegrass	5
				Scribner panicum	5
				Purpletop	5
				Perennial sunflower	5
				Goldenrod	5
				Trees	15
				Other perennial grasses	5
Yahola:					
55	Loamy Bottomland	Favorable	8,500	Big bluestem	25
		Normal	6,100	Indiangrass	15
		Unfavorable	4,500	Switchgrass	15
				Little bluestem	10
				Eastern gamagrass	5
				Tall dropseed	5
				Beaked panicum	5
				Compassplant	5
				Sedges	5
				Heath aster	5
				Trees	5

See footnotes at end of table.

TABLE 6.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lbs/ acre		Pct
Zaneis:					
56, 57----------	Loamy Prairie----------	Favorable	5,500	Little bluestem----------	25
		Normal	3,600	Big bluestem----------	20
		Unfavorable	2,500	Indiangrass----------	10
				Switchgrass----------	10
				Canada wildrye----------	5
				Side-oats grama----------	5
				Blue grama----------	5
				Tall dropseed----------	5
				Other perennial grasses-------	15

[1]This mapping unit is made up of two or more dominant kinds of soils. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed in this table. Absence of an entry in a column means the information was not available]

Soil name and map symbol	Suitability group	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Important trees	Site index	
Asher: 1	3o4	Slight	Slight	Moderate	Moderate	Pecan Black walnut Green ash	--- --- ---	Bur oak, pecan, black walnut, green ash.
Fluvents: 14	3o4	Slight	Slight	Moderate	Moderate	Eastern cottonwood Pecan Green ash Black walnut	90 --- --- ---	Eastern cottonwood, black walnut, bur oak, pecan, green ash.
Gaddy: 15	3s6	Moderate	Slight	Severe	Moderate	Eastern cottonwood	88	Eastern cottonwood, American sycamore.
Gracemont: 17	3w4	Slight	Slight	Slight	Moderate	Eastern cottonwood	86	Eastern cottonwood.
Gracemore: 18	3w5	Slight	Slight	Slight	---	Eastern cottonwood	90	Eastern cottonwood.
Harjo: 20	4w6	Slight	Severe	Moderate	Moderate	Eastern cottonwood Green ash Bur oak	80 --- ---	Eastern cottonwood, green ash, bur oak.
Keokuk: 21	3o4	Slight	Slight	Moderate	Moderate	Pecan Black walnut Green ash	--- --- ---	Bur oak, pecan, black walnut, green ash.
Latanier: 27	2w6	Slight	Moderate	Moderate	---	Green ash Pecan Eastern cottonwood American sycamore	80 --- 110 ---	Eastern cottonwood, American sycamore.
Lela: 28	3w6	Slight	Moderate	Moderate	Moderate	Eastern cottonwood Black walnut Pecan	90 --- ---	Eastern cottonwood, green ash, bur oak, black walnut.
Port: 33, [1]34	3o4	Slight	Slight	Slight	Moderate	Eastern cottonwood Pecan Green ash Black walnut	90 --- --- ---	Eastern cottonwood, black walnut, bur oak, pecan, green ash.
Pulaski: 35	3o4	Slight	Slight	Moderate	Moderate	Eastern cottonwood Pecan Green ash Black walnut	90 --- --- ---	Eastern cottonwood, black walnut, bur oak, pecan, green ash.
Sayers: [1]38	2o6	Slight	Slight	Slight	Slight	Eastern cottonwood	100	Eastern cottonwood, black walnut.
Tribbey: 45	3w4	Slight	Moderate	Moderate	Moderate	Eastern cottonwood	90	Eastern cottonwood.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Suitability group	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Important trees	Site index	
Vernon:								
[1]50:								
Vernon part.	None							
Port part--------	3o4	Slight	Slight	Slight	Moderate	Eastern cottonwood--	90	Eastern cottonwood,
						Pecan----------	---	black walnut,
						Green ash----------	---	bur oak,
						Black walnut--------	---	pecan,
								green ash.
Yahola:								
55----------	3o4	Slight	Slight	Moderate	Moderate	Eastern cottonwood--	90	Eastern cottonwood,
						Pecan----------	---	black walnut,
						Green ash----------	---	bur oak,
						Black walnut--------	---	pecan,
								green ash.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 8.--WOODLAND UNDERSTORY VEGETATION

[Only the soils suitable for production of commercial trees are listed in this table]

Soil name and map symbol	Potential production		Common plant name	Composition
	Kind of year	Dry weight		
		Lbs/acre		Pct
Asher:				
1----------	Favorable	4,300	Big bluestem----------	25
	Normal	3,100	Indiangrass----------	15
	Unfavorable	2,300	Switchgrass----------	15
			Little bluestem----------	10
			Other grasses----------	20
			Other shrubs----------	10
			Trees----------	10
Fluvents:				
14----------	Favorable	3,500	Big bluestem----------	25
	Normal	2,500	Indiangrass----------	15
	Unfavorable	1,800	Switchgrass----------	15
			Little bluestem----------	10
			Eastern gamagrass----------	5
			Tall dropseed----------	5
			Beaked panicum----------	5
			Compassplant----------	5
			Sedges----------	5
			Heath aster----------	5
			Trees----------	5
Gaddy:				
15----------	Favorable	2,000	Switchgrass----------	30
	Normal	1,500	Sand bluestem----------	15
	Unfavorable	1,000	Indiangrass----------	15
			Little bluestem----------	5
			Texas bluegrass----------	5
			Beaked panicum----------	5
			Purpletop----------	5
			Goldenrod----------	5
			Heath aster----------	5
			Maximilian sunflower----------	5
			Trees----------	5
Gracemont:				
17----------	Favorable	4,500	Switchgrass----------	25
	Normal	3,900	Big bluestem----------	20
	Unfavorable	3,500	Indiangrass----------	10
			Eastern gamagrass----------	10
			Canada wildrye----------	5
			Maximilian sunflower----------	5
			Other perennial grasses----------	20
			Trees----------	5
Gracemore:				
18----------	Favorable	4,500	Switchgrass----------	25
	Normal	3,800	Big bluestem----------	20
	Unfavorable	3,500	Indiangrass----------	10
			Eastern gamagrass----------	10
			Beaked panicum----------	10
			Canada wildrye----------	5
			Scribner panicum----------	5
			Purpletop----------	5
			Maximilian sunflower----------	5
			Trees----------	5

See footnote at end of table.

TABLE 8.--WOODLAND UNDERSTORY VEGETATION--Continued

Soil name and map symbol	Potential production		Common plant name	Composition
	Kind of year	Dry weight		
		Lbs/acre		Pct
Harjo:				
20	Favorable	2,200	Bushy bluestem	20
	Normal	1,800	Willow	15
	Unfavorable	1,500	Eastern cottonwood	15
			Switchgrass	10
			Indiangrass	5
			Big bluestem	5
			Little bluestem	5
			Beaked panicum	5
			Sedges	5
			Cattail	5
			Trees	10
Keokuk:				
21	Favorable	4,300	Big bluestem	25
	Normal	3,200	Indiangrass	15
	Unfavorable	2,300	Switchgrass	15
			Little bluestem	10
			Eastern gamagrass	5
			Tall dropseed	5
			Florida paspalum	5
			Canada wildrye	5
			Maximilian sunflower	5
			Eastern cottonwood	5
			Trees	5
Latanier:				
27	Favorable	3,200	Switchgrass	20
	Normal	2,400	Western wheatgrass	10
	Unfavorable	1,800	Canada wildrye	10
			Tall dropseed	10
			Other perennial grasses	40
			Trees	10
Lela:				
28	Favorable	2,800	Big bluestem	25
	Normal	1,900	Switchgrass	15
	Unfavorable	1,300	Indiangrass	15
			Prairie cordgrass	10
			Western wheatgrass	5
			Tall dropseed	5
			Perennial sunflower	5
			Goldenrod	5
			Sedges	5
			Trees	10
Port:				
33, [1]34	Favorable	4,300	Big bluestem	25
	Normal	3,100	Indiangrass	15
	Unfavorable	2,300	Switchgrass	15
			Little bluestem	10
			Eastern gamagrass	5
			Tall dropseed	5
			Beaked panicum	5
			Compassplant	5
			Heath aster	5
			Sedges	5
			Trees	5

See footnotes at end of table.

TABLE 8.--WOODLAND UNDERSTORY VEGETATION--Continued

Soil name and map symbol	Potential production		Common plant name	Composition
	Kind of year	Dry weight		
		Lbs/acre		Pct
Pulaski:				
35----------	Favorable	4,300	Big bluestem----------	25
	Normal	3,100	Indiangrass----------	15
	Unfavorable	2,300	Switchgrass----------	15
			Little bluestem----------	10
			Eastern gamagrass----------	5
			Tall dropseed----------	5
			Beaked panicum----------	5
			Compassplant----------	5
			Sedges----------	5
			Heath aster----------	5
			Trees----------	5
Sayers:				
[1]38----------	Favorable	2,200	Switchgrass----------	30
	Normal	1,500	Sand bluestem----------	15
	Unfavorable	1,00	Indiangrass----------	15
			Little bluestem----------	5
			Texas bluegrass----------	5
			Beaked panicum----------	5
			Purpletop----------	5
			Goldenrod----------	5
			Heath aster----------	5
			Maximilian sunflower----------	5
			Trees----------	5
Tribbey:				
45----------	Favorable	2,500	Switchgrass----------	25
	Normal	1,800	Bushy bluestem----------	25
	Unfavorable	1,500	Sedges----------	10
			Eastern gamagrass----------	5
			Indiangrass----------	5
			Big bluestem----------	5
			Beaked panicum----------	5
			Rushes----------	5
			Other shrubs----------	10
			Trees----------	5
Vernon:				
[1]50:				
Vernon part.				
Port part--------	Favorable	4,400	Big bluestem----------	25
	Normal	3,000	Indiangrass----------	15
	Unfavorable	2,200	Switchgrass----------	15
			Little bluestem----------	10
			Eastern gamagrass----------	5
			Tall dropseed----------	5
			Beaked panicum----------	5
			Compassplant----------	5
			Heath aster----------	5
			Sedges----------	5
			Trees----------	5
Yahola:				
55----------	Favorable	4,300	Big bluestem----------	25
	Normal	3,100	Indiangrass----------	15
	Unfavorable	2,300	Switchgrass----------	15
			Little bluestem----------	10
			Eastern gamagrass----------	5
			Tall dropseed----------	5
			Beaked panicum----------	5
			Compassplant----------	5
			Sedges----------	5
			Heath aster----------	5
			Trees----------	5

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 9.--BUILDING SITE DEVELOPMENT

["Shrink-swell," "floods," and other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Asher: 1	Moderate: wetness, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength.
Aydelotte: 2, 3	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Borrow Pits: 4.					
Carytown: 5	Severe: wetness, too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell, wetness.	Severe: low strengh, shrink-swell.	Severe: wetness, low strength, shrink-swell.
Chickasha: 6	Slight	Slight	Slight	Slight	Moderate: low strength.
7	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
[1]8: Chickasha part	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
Zaneis part	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength, slope.	Moderate: shrink-swell, low strength.
Chigley: [1]9	Severe: too clayey.	Severe: low strength.	Severe: low strength.	Severe: low strength.	Severe: low strength.
Dougherty: 10	Moderate: cutbanks cave.	Slight	Slight	Slight	Moderate: low strength.
11	Moderate: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: low strength.
Eufaula: 12	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
13	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Moderate: slope.	Moderate: slope.
Fluvents: 14	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: slope, low strength, floods.
Gaddy: 15	Severe: floods, cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.

See footnotes at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Galey: 16	Moderate: wetness.	Slight	Moderate: wetness.	Slight	Moderate: low strength.
Gracemont: 17	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: floods.
Gracemore: 18	Severe: wetness, floods, cutbanks cave.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: floods.
Gravel Pits: 19.					
Harjo: 20	Severe: too clayey, wetness, floods.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.
Keokuk: 21	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength.
Kirkland: 22	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Konawa: 23, 24, 25	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
26	Slight	Slight	Slight	Slight	Moderate: low strength.
Latanier: 27	Severe: too clayey, floods, wetness.	Severe: shrink-swell, floods, low strength.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, floods, low strength.	Severe: shrink-swell, low strength.
Lela: 28	Severe: floods, wetness, too clayey.	Severe: low strength, floods, shrink-swell.	Severe: low strength, floods, shrink-swell.	Severe: low strength, floods, shrink-swell.	Severe: low strength, shrink-swell.
Miller: 29	Severe: floods, too clayey.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: low strength, shrink-swell.
Noble: 30	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.

See footnotes at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Norge:					
31	Moderate: too clayey.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Severe: low strength.
32	Moderate: too clayey.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell, slope.	Severe: low strength.
Port:					
33	Severe: floods.	Severe: floods.	Severe: floods	Severe: floods.	Moderate: floods, low strength, shrink-swell
134	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Pulaski:					
35	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods. low strength.
Renfrow:					
36, 37	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Sayers:					
138	Severe: floods, cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
Seminole:					
39, 40	Severe: wetness, too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe low strength, shrink-swell.	Severe: low strength, shrink-swell.
Stephenville:					
41	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Slight	Moderate: low strength.
42	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Moderate: low strength.
143:					
Stephenville part	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope, low strength.
Darnell part	Moderate: depth to rock, slope.	Moderate: depth to rock, slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: depth to rock, slope, low strength.
Teller:					
44	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
Tribbey:					
45	Severe: floods, wetness.	Severe: floods.	Severe: wetness, floods.	Severe: floods.	Severe: floods.
Vanoss:					
46, 47	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: low strength, shrink-swell.

See footnotes at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Vernon:					
48, 49	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
[1]50:					
Vernon part	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
Port part	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Weatherford:					
51, 52	Slight	Slight	Slight	Slight	Moderate: low strength.
[1]53:					
Weatherford part	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
Stephenville part	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Moderate: low strength.
Windthorst:					
54	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Yahola:					
55	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: low strength, floods.
Zaneis:					
56	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.
57	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength, slope.	Moderate: shrink-swell, low strength.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 10.--SANITARY FACILITIES

["Percs slowly," "floods," and other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils. Absence of an entry means soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Asher: 1	Moderate: floods.	Moderate: seepage.	Moderate: floods.	Moderate: floods.	Fair: too clayey.
Aydelotte: 2, 3	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: thin layer.
Borrow Pits: 4.					
Carytown: 5	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey, wetness.	Severe: wetness.	Poor: wetness.
Chickasha: 6, 7	Moderate: depth to rock.	Moderate: seepage, depth to rock.	Moderate: depth to rock.	Slight	Good.
[1]8: Chickasha part	Moderate: depth to rock.	Moderate: seepage, depth to rock.	Moderate: depth to rock.	Slight	Good.
Zaneis part	Severe: percs slowly.	Moderate: depth to rock, slope.	Moderate: too clayey, depth to rock.	Slight	Fair: thin layer.
Chigley: [1]9	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey, depth to rock.	Moderate: wetness.	Poor: hard to pack, too clayey.
Dougherty: 10, 11	Slight	Severe: seepage.	Severe: seepage.	Slight	Fair: too sandy.
Eufaula: 12	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
13	Moderate: slope.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
Fluvents: 14	Severe: floods.	Severe: floods	Severe: floods.	Severe: floods.	Fair: slope.
Gaddy: 15	Severe: floods.	Severe: seepage, floods.	Severe: seepage, too sandy, floods.	Severe: floods, seepage.	Fair: too sandy.
Galey: 16	Moderate: percs slowly, wetness.	Moderate: seepage.	Slight	Moderate: wetness.	Good.

See footnotes at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Gracemont: 17	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Severe: floods, seepage, wetness.	Severe: wetness, floods, seepage.	Good.
Gracemore: 18	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Severe: floods, too sandy, wetness.	Severe: wetness, floods, seepage.	Poor: too sandy.
Gravel Pits: 19.					
Harjo: 20	Severe: wetness, floods, percs slowly.	Severe: wetness, floods.	Severe: wetness, floods, too clayey.	Severe: wetness, floods.	Poor: too clayey, wetness.
Keokuk: 21	Moderate: floods.	Moderate: seepage.	Moderate: floods, seepage.	Moderate: floods.	Good.
Kirkland: 22	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: thin layer, too clayey.
Konawa: 23	Slight	Severe: seepage.	Severe: seepage.	Slight	Fair: thin layer.
24, 25, 26	Slight	Severe: seepage.	Severe: seepage.	Slight	Good.
Latanier: 27	Severe: percs slowly, floods, wetness.	Severe: floods.	Severe: too clayey, floods, wetness.	Severe: floods, wetness.	Poor: too clayey.
Lela: 28	Severe: percs slowly, floods.	Slight	Severe: floods, too clayey.	Severe: floods.	Poor: too clayey.
Miller: 29	Severe: percs slowly, floods.	Severe: floods.	Severe: floods, too clayey.	Severe: floods.	Poor: too clayey, hard to pack.
Noble: 30	Slight	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Good.
Norge: 31, 32	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: thin layer.

See footnotes at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Port:					
33	Severe: floods.	Moderate: seepage.	Severe: floods.	Severe: floods.	Good.
[1]34	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
Pulaski:					
35	Severe: floods.	Severe: seepage, floods.	Severe: floods, seepage.	Severe: floods, seepage.	Good.
Renfrow:					
36, 37	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: thin layer.
Sayers:					
[1]38	Severe: floods.	Severe: floods, seepage.	Severe: floods, too sandy, seepage.	Severe: seepage, floods.	Fair: too sandy.
Seminole:					
39, 40	Severe: percs slowly, wetness.	Severe: unstable fill.	Severe: too clayey.	Severe: wetness.	Poor: thin layer.
Stephenville:					
41, 42	Severe: depth to rock.	Severe: depth to rock, slope.	Moderate: depth to rock.	Slight	Fair: thin layer.
[1]43:					
Stephenville part	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Moderate: depth to rock.	Moderate: slope.	Fair: thin layer.
Darnell part	Severe: depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage.	Severe: seepage, slope.	Poor: thin layer, slope.
Teller:					
44	Slight	Severe: seepage.	Severe: seepage.	Slight	Good.
Tribbey:					
45	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: floods.	Good.
Vanoss:					
46, 47	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Vernon:					
48	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
49	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight	Poor: too clayey.
[1]50:					
Vernon part	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Port part	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.

See footnotes at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Weatherford: 51, 52	Moderate: depth to rock.	Moderate: slope, seepage, depth to rock.	Moderate: depth to rock.	Slight	Fair: area reclaim.
[1]53: Weatherford part--	Moderate: depth to rock	Moderate: slope, seepage, depth to rock.	Moderate: depth to rock.	Slight	Fair: area reclaim.
Stephenville part-	Severe: depth to rock.	Severe: depth to rock, slope.	Moderate: depth to rock.	Slight	Fair: thin layer.
Windthorst: 54	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Yahola: 55	Severe: floods.	Severe: seepage, floods.	Severe: floods, seepage.	Severe: floods, seepage.	Good.
Zaneis: 56, 57	Severe: percs slowly.	Moderate: depth to rock, slope.	Moderate: too clayey, depth to rock.	Slight	Fair: thin layer.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 11.--CONSTRUCTION MATERIALS

["Shrink-swell" and other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor," and "unsuited." Absence of an entry means soil was not rated]

Soil name and map symbol	Road fill	Sand	Gravel	Topsoil
Asher: 1	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Aydelotte: 2, 3	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
Borrow Pits: 4.				
Carytown: 5	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Chickasha: 6, 7	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
18: Chickasha part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Zaneis part	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Chigley: 19	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
Dougherty: 10, 11	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Eufaula: 12, 13	Good	Poor: excess fines.	Unsuite: excess fines.	Poor: too sandy.
Fluvents: 14	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Gaddy: 15	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Galey: 16	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines	Fair: thin layer.
Gracemont: 17	Fair: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Gracemore: 18	Fair: low strength, wetness.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Gravel Pits: 19.				

See footnotes at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Road fill	Sand	Gravel	Topsoil
Harjo: 20	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
Keokuk: 21	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Kirkland: 22	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuite: excess fines.	Fair: thin layer.
Konawa: 23	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
24, 25, 26	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Latanier: 27	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Lela: 28	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Miller: 29	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Noble: 30	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Norge: 31, 32	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Port: 33	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
[1]34	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Pulaski: 35	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
Renfrow: 36, 37	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Sayers: [1]38	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.

See footnotes at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Road fill	Sand	Gravel	Topsoil
Seminole 39, 40	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Stephenville: 41, 42	Fair: thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
[1]43: Stephenville part	Fair: thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
Darnell part	Fair: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
Teller: 44	Good	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Tribbey: 45	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Vanoss: 46, 47	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Vernon: 48	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
49	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
[1]50: Vernon part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited excess fines.	Poor: too clayey.
Port part	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Weatherford: 51, 52	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
[1]53: Weatherford part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Stephenville part	Fair: thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Windthorst: 54	Fair: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.

See footnotes at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Road fill	Sand	Gravel	Topsoil
Yahola: 55	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
Zaneis: 56, 57	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 12.--WATER MANAGEMENT

["Seepage," "slope," and other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not evaluated]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Asher: 1	Moderate: seepage.	Moderate: unstable fill, compressible, piping.	Floods	Slow intake	Favorable	Favorable.
Aydelotte: 2, 3	Slight	Moderate: unstable fill, compressible.	Not needed	Erodes easily, slow intake.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Borrow Pits: 4.						
Carytown: 5	Slight	Moderate: unstable fill, compressible.	Percs slowly	Slow intake	Percs slowly	Percs slowly, excess sodium.
Chickasha: 6, 7	Moderate: depth to rock, seepage.	Moderate: thin layer.	Not needed	Erodes easily	Erodes easily	Erodes easily.
18: Chickasha part	Moderate: depth to rock, seepage.	Moderate: thin layer.	Not needed	Erodes easily	Erodes easily	Erodes easily.
Zaneis part	Moderate: seepage, depth to rock.	Moderate: thin layer, unstable fill, piping.	Not needed	Erodes easily	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Chigley: 19	Moderate: depth to rock, seepage.	Moderate: unstable fill, compressible.	Not needed	Erodes easily, slow intake.	Erodes easily, percs slowly.	Percs slowly.
Dougherty: 10, 11	Severe: seepage,	Moderate: unstable fill, compressible, piping.	Favorable	Fast intake, seepage. erodes easily.	Erodes easily, too sandy.	Erodes easily, fast intake.
Eufaula: 12	Severe: seepage.	Moderate: unstable fill, piping.	Favorable	Seepage, fast intake, droughty.	Seepage, fast intake, droughty.	Erodes easily, droughty, fast intake.
13	Severe: seepage.	Moderate: unstable fill, piping.	Slope	Seepage, fast intake, droughty, slope.	Seepage, fast intake, droughty, slope.	Erodes easily, droughty, fast intake.
Fluvents: 14	Moderate: seepage.	Moderate: unstable fill, seepage.	Slope	Slope, erodes easily, floods.	Slope, erodes easily.	Slope.
Gaddy: 15	Severe: seepage.	Moderate: unstable fill, piping.	Floods	Seepage, floods, fast intake.	Erodes easily	Erodes easily.

See footnotes at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Galey: 16	Moderate: seepage.	Moderate: unstable fill, piping, compressible.	Favorable	Favorable	Favoable	Favorable.
Gracemont: 17	Severe: seepage.	Moderate: unstable fill, piping.	Floods	Wetness, seepage, floods.	Floods	Wetness, seepage.
Gracemore: 18	Severe: seepage.	Moderate: unstable fill, low strength, piping.	Wetness, floods, cutbanks cave.	Wetness, seepage, floods.	Floods	Wetness, seepage.
Gravel Pits: 19.						
Harjo: 20	Slight	Moderate: compressible, unstable fill.	Floods, wetness, percs slowly.	Floods, wetness, slow intake.	Wetness	Wetness.
Keokuk: 21	Moderate: seepage.	Moderate: piping, compressible, low strength.	Favorable	Favorable	Favorable	Favorable.
Kirkland: 22	Slight	Severe: compressible, piping.	Favorable	Slow intake	Percs slowly, piping.	Percs slowly.
Konawa: 23, 24, 25, 26	Severe: seepage.	Moderate: low strength, unstable fill, piping.	Favorable	Erodes easily	Erodes easily	Erodes easily.
Latanier: 27	Slight	Moderate: shrink-swell, low strength, compressible.	Percs slowly	Slow intake	Percs slowly, floods.	Wetness.
Lela: 28	Slight	Moderate: unstable fill, compressible.	Percs slowly, wetness, floods.	Slow intake, wetness.	Floods	Percs slowly, wetness.
Miller: 29	Slight	Moderate: unstable fill, compressible.	Floods, percs slowly.	Floods, slow intake.	Floods	Percs slowly.
Noble: 30	Severe: seepage.	Moderate: unstable fill, piping, low strength.	Slope	Seepage	Seepage	Erodes easily.
Norge: 31, 32	Moderate: seepage.	Moderate: piping, unstable fill.	Favorable	Erodes easily	Erodes easily	Erodes easily.

See footnotes at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Port: 33, [1]34	Moderate: seepage.	Moderate: unstable fill, compressible, piping.	Floods	Erodes easily	Floods	Erodes easily.
Pulaski: 35	Severe: seepage.	Moderate: unstable fill, seepage, piping.	Floods	Floods	Floods	Erodes easily.
Renfrow: 36, 37	Slight	Moderate: unstable fill, compressible.	Favorable	Erodes easily, slow intake.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Sayers: [1]38	Severe: seepage.	Moderate: unstable fill, seepage, piping.	Floods	Floods, seepage.	Floods, erodes easily, seepage.	Erodes easily, droughty.
Seminole: 39, 40	Slight	Severe: unstable fill.	Percs slowly	Slow intake, erodes easily.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Stephenville: 41, 42	Severe: depth to rock.	Moderate: thin layer.	Favorable	Erodes easily	Erodes easily	Erodes easily.
[1]43: Stephenville part	Severe: depth to rock.	Moderate: thin layer.	Slope	Slope	Slope	Slope.
Darnell part	Severe: depth to rock, seepage.	Severe: thin layer.	Slope	Slope	Slope	Slope.
Teller: 44	Severe: seepage.	Moderate: unstable fill, piping.	Favorable	Erodes easily	Erodes easily, piping.	Erodes easily.
Tribbey: 45	Severe: seepage.	Moderate: compressible.	Floods, wetness.	Wetness, floods.	Wetness, floods.	Wetness.
Vanoss: 46, 47	Moderate: seepage.	Moderate: unstable fill, low strength, piping.	Favorable	Favorable	Favorable	Favorable.
Vernon: 48, 49	Slight	Moderate: compressible, low strength, shrink-swell.	Slope	Complex slope, slow intake, droughty.	Complex slope, percs slowly.	Droughty, percs slowly, slope.
[1]50: Vernon part	Slight	Moderate: compressible, low strength, shrink-swell.	Slope	Complex slope, slow intake, droughty.	Complex slope, percs slowly.	Droughty, percs slowly, slope.
Port part	Moderate: seepage.	Moderate: unstable fill, compressible, piping.	Floods	Erodes easily, floods.	Floods	Erodes easily.

See footnotes at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Weatherford: 51, 52	Moderate: depth to rock, seepage.	Moderate: erodes easily, piping.	Favorable	Erodes easily	Erodes easily	Erodes easily.
[1]53: Weatherford part	Moderate: depth to rock, seepage.	Moderate: erodes easily, piping.	Slope	Erodes easily	Erodes easily	Erodes easily.
Stephenville part	Severe: depth to rock.	Moderate: thin layer.	Slope	Erodes easily	Erodes easily	Erodes easily.
Windthorst: 54	Moderate: seepage.	Moderate: compressible.	Percs slowly	Slow intake, erodes easily.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Yahola: 55	Severe: seepage.	Moderate: unstable fill, seepage, piping.	Floods	Floods	Floods	Not needed.
Zaneis: 56, 57	Moderate: seepage, depth to rock.	Moderate: thin layer, unstable fill, piping.	Favorable	Erodes easily	Erodes easily, percs slowly.	Erodes easily, percs slowly.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit descripion for the composition and behavior of the whole mapping unit.

TABLE 13.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates the soil was not rated]

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Asher: 1	Good	Good	Fair	Good	Good	Fair	Poor	Poor	Good	Good	Poor	Fair.
Aydelotte: 2	Good	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
3	Good	Good	Fair	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
Borrow Pits: 4.												
Carytown: 5	Poor	Fair	Fair	---	---	Fair	Good	Fair	Fair	---	Fair	Fair.
Chickasha: 6, 7	Good	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
[1]8: Chickasha part	Good	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
Zaneis part	Good	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
Chigley: [1]9	Fair	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
Dougherty: 10, 11	Fair	Fair	Good	---	---	Good	Poor	Very poor.	Fair	---	Very poor.	Good.
Eufaula: 12, 13	Fair	Fair	Fair	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Fluvents: 14	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
Gaddy: 15.												
Galey: 16	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
Gracemont: 17	Poor	Fair	Fair	---	---	Fair	Fair	Poor	Fair	---	Poor	Fair.
Gracemore: 18	Poor	Fair	Fair	---	---	Fair	Fair	Poor	Fair	---	Poor	Fair.
Gravel Pits: 19.												
Harjo: 20	Poor	Fair	Fair	Fair	Fair	---	Poor	Good	Fair	Fair	Fair	---
Keokuk: 21	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.

See footnotes at end of table.

TABLE 13.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Kirkland:												
22	Good	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
Konawa:												
23	Fair	Fair	Good	---	---	Good	Poor	Very poor.	Fair	---	Very poor.	Good.
24, 25	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
26	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
Latanier:												
27	Fair	Good	Fair	Good	Good	Good	Good	Good	Fair	Good	Good	Fair
Lela:												
28	Fair	Fair	Fair	Good	Good	---	Poor	Fair	Fair	Good	Poor	---
Miller:												
29	Good	Good	Fair	---	---	Fair	Poor	Poor	Good	---	Poor	Fair.
Noble:												
30	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
Norge:												
31, 32	Good	Good	Fair	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
Port:												
33	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
[1]34	Poor	Fair	Fair	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good
Pulaski:												
35	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good
Renfrow:												
36, 37	Good	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
Sayers:												
[1]38	Poor	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Seminole:												
39	Good	Good	Good	---	---	Fair	Poor	Poor	Good	---	Poor	Fair.
40	Good	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
Stephenville:												
41, 42	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
[1]43:												
Stephenville part	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good
Darnell part	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.

See footnotes at end of table.

TABLE 13.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Teller: 44	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
Tribbey: 45	Poor	Fair	Fair	Good	Good	---	Good	Good	Fair	Good	Good	---
Vanoss: 46,47	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good
Vernon: 48	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
49	Fair	Fair	Poor	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
[1]50: Vernon part	Fair	Fair	Poor	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair
Port part	Poor	Fair	Fair	---	---	Good	Poor	Very poor.	Fair	---	Very poor.	Fair
Weatherford: 51, 52	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good
[1]53: Weatherford part	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good
Stephenville part	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
Windthorst: 54	Good	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
Yahola: 55	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good
Zaneis: 56, 57	Good	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 14.--RECREATIONAL DEVELOPMENT

["Percs slowly," "floods," and other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe"]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Asher: 1	Severe: floods.	Moderate: floods, too clayey.	Moderate: floods, percs slowly, too clayey.	Moderate: too clayey.
Aydelotte: 2	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
3	Severe: percs slowly, too clayey.	Moderate: too clayey.	Severe: percs slowly, too clayey.	Moderate: too clayey.
Borrow Pits: 4.				
Carytown: 5	Severe: wetness.	Severe: wetness.	Severe; wetness.	Severe: wetness.
Chickasha: 6, 7	Slight	Slight	Moderate: slope.	Slight.
[1]8: Chickasha part	Slight	Slight	Moderate: slope.	Slight.
Zaneis part	Moderate: percs slowly.	Slight	Moderate: percs slowly, slope.	Slight.
Chigley: 9	Moderate: percs slowly, small stones.	Moderate: small stones.	Severe: small stones.	Slight.
Dougherty: 10, 11	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Eufaula: 12, 13	Moderate: too sandy.	Moderate: too sandy.	Severe: too sandy.	Severe: too sandy.
Fluvents: 14	Severe: floods.	Moderate: slope.	Severe: slope.	Slight.
Gaddy: 15	Severe: floods.	Moderate: floods.	Moderate: floods.	Moderate: floods.
Galey: 16	Slight	Slight	Slight	Slight.
Gracemont: 17	Severe: floods, wetness.	Severe: floods.	Severe: floods.	Moderate: floods, wetness.
Gracemore: 18	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: wetness, floods.

See footnotes at end of table.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Gravel Pits: 19.				
Harjo: 20	Severe: too clayey, wetness, floods.	Severe: floods, too clayey, wetness.	Severe: wetness, floods, percs slowly.	Severe: wetness, floods, too clayey.
Keokuk: 21	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
Kirkland: 22	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
Konawa: 23	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
24	Slight	Slight	Slight	Slight.
25, 26	Slight	Slight	Moderate: slope.	Slight.
Latanier: 27	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: too clayey.
Lela: 28	Severe: floods, percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
Miller: 29	Severe: floods, percs slowly, too clayey.	Moderate: floods.	Severe: percs slowly.	Moderate: too clayey.
Noble: 30	Slight	Slight	Moderate: slope.	Slight.
Norge: 31, 32	Moderate: percs slowly.	Slight	Moderate: percs slowly, slope.	Slight.
Port: 33	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
[1]34	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
Pulaski: 35	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
Renfrow: 36, 37	Severe: percs slowly.	Slight	Severe: slope, percs slowly.	Slight.

See footnotes at end of table.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Sayers:				
[1]38	Severe: floods.	Moderate: floods, too sandy.	Moderate: floods, too sandy.	Moderate. floods, too sandy.
Seminole:				
39, 40	Moderate: percs slowly.	Slight	Moderate: percs slowly, slope.	Slight.
Stephenville:				
41, 42	Slight	Slight	Moderate: slope.	Slight.
[1]43:				
Stephenville part	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Darnell part	Moderate: slope.	Moderate: slope.	Severe: depth to rock, slope.	Slight.
Teller:				
44	Slight	Slight	Moderate: slope.	Slight.
Tribbey:				
45	Severe: wetness, floods.	Severe: floods.	Severe: floods, wetness.	Moderate: wetness, floods.
Vanoss:				
46	Slight	Slight	Slight	Slight.
47	Slight	Slight	Moderate: slope.	Slight.
Vernon:				
48	Severe: percs slowly.	Moderate: too clayey.	Severe: percs slowly, too clayey.	Moderate: too clayey.
49	Severe: percs slowly.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
[1]50:				
Vernon part	Severe: percs slowly.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
Port part	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
Weatherford:				
51, 52	Slight	Slight	Moderate: slope.	Slight.
[1]53:				
Weatherford part	Slight	Slight	Severe: slope.	Slight.
Stephenville part	Slight	Slight	Moderate: slope.	Slight.

See footnotes at end of table.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Windthorst: 54	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
Yahola: 55	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
Zaneis: 56, 57	Moderate: percs slowly.	Slight	Moderate: percs slowly, slope.	Slight.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments >3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Asher:											
1	0-21	Silty clay loam	CL	A-7, A-6	0	100	100	95-100	90-98	37-50	15-25
	21-65	Silt loam, loam, very fine sandy loam.	ML, CL, CL-ML	A-4	0	100	100	85-100	51-97	<30	NP-10
Aydelotte:											
2	0-6	Loam	ML, CL	A-4, A-6	0	100	100	96-100	65-85	30-37	8-14
	6-63	Clay, silty clay, clay loam.	CH, MH, CL, ML	A-7, A-6	0	100	98-100	96-100	80-99	37-70	15-38
3	0-4	Clay loam	CL	A-6, A-7	0	100	100	96-100	80-90	33-50	12-26
	4-63	Clay, silty clay, clay loam.	CH, MH, CL, ML	A-7, A-6	0	100	98-100	96-100	80-99	37-70	15-38
Borrow Pits:											
4.											
Carytown:											
5	0-11	Silt loam	ML	A-4, A-6	0	100	95-100	90-99	61-85	22-35	2-18
	11-70	Clay, silty clay.	CL, ML, CH, CL	A-7	0	100	92-100	90-100	80-98	41-65	18-38
Chickasha:											
6, 7	0-14	Loam	ML, CL-ML	A-4	0	100	98-100	94-100	60-70	<26	NP-6
	14-36	Sandy clay loam, clay loam, loam.	CL, SC	A-4, A-6	0	100	100	90-100	40-70	28-39	9-18
	36-53	Sandy clay loam, loam.	CL, SC	A-4, A-6	0	98-100	98-100	90-100	40-70	26-37	8-16
	53-65	Weathered bedrock.									
[1]8:											
Chickasha part	0-12	Fine sandy loam, loam.	ML, CL-ML, SM, SM-SC	A-4	0	100	98-100	94-100	36-70	<26	NP-6
	12-30	Sandy clay loam, clay loam, loam.	CL, SC	A-4, A-6	0	100	100	90-100	40-70	28-39	9-18
	30-42	Sandy clay loam, loam.	CL, SC	A-4, A-6	0	98-100	98-100	90-100	40-70	26-37	8-16
	42-50	Weathered bedrock.									
Zaneis part	0-7	Loam, fine sandy loam.	SM, SC, ML, CL	A-4	0	100	98-100	94-100	36-85	23-31	3-10
	7-45	Loam, clay loam, sandy clay loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0	100	100	90-100	36-90	25-40	7-18
	45-55	Clay loam, sandy clay loam, fine sandy loam.	SM, SC, ML, CL	A-4, A-6	0-7	90-100	90-100	85-100	36-90	20-40	2-18
	55-60	Weathered bedrock.									
Chigley:											
[1]9	0-16	Gravelly sandy loam.	SM, SC	A-2, A-4	0	65-80	55-70	50-65	20-40	<30	NP-9
	16-42	Sandy clay, clay, gravelly sandy clay.	CL, CH, SC, GC	A-2, A-6, A-7	0	60-95	50-92	36-85	20-75	32-60	11-35
	42-60	Gravelly clay.	SC, GC, CL, CH	A-2, A-6, A-7	0	60-95	50-92	36-85	20-75	32-60	11-35

See footnotes at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments >3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Dougherty:											
10, 11	0-23	Loamy fine sand	SM	A-2	0	100	98-100	90-100	15-35	---	NP
	23-40	Fine sandy loam, sandy clay loam.	ML, SM, CL, SC	A-4, A-6	0	100	98-100	90-100	36-65	<37	NP-16
	40-72	Fine sandy loam, sandy clay loam, loamy fine sand.	SM, ML, CL, SC	A-4, A-6 A-2	0	100	98-100	90-100	15-65	<37	NP-16
Eufaula:											
12, 13	0-72	Fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	100	98-100	82-100	5-35	---	NP
Fluvents:											
14	0-60	Very fine sandy loam, loam, silt loam, fine sandy loam.	SM, ML, SC, CL	A-4	0	100	98-100	94-100	36-95	<31	NP-10
Gaddy:											
15	0-8	Loamy fine sand	SM	A-2	0	100	98-100	90-100	15-35	---	NP
	8-60	Loamy fine sand, fine sand.	SM	A-2, A-4	0	100	98-100	90-100	15-36	---	NP
Galey:											
16	0-12	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4	0	100	98-100	94-100	40-60	<25	NP-6
	12-65	Sandy clay loam, fine sandy loam, clay loam.	SM-SC, SC, CL-ML, CL	A-4, A-6	0	100	98-100	90-100	40-65	26-40	6-18
Gracemont:											
17	0-10	Fine sandy loam	ML, SM	A-4,	0	100	98-100	94-100	36-60	<25	NP-4
	10-60	Fine sandy loam, loam.	ML, CL, SM	A-4	0	100	98-100	94-100	36-60	<25	NP-4
Gracemore:											
18	0-10	Fine sand-------	SM, SP-SM	A-2, A-3	0	100	98-100	82-98	5-25	---	NP
	10-72	Fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	100	98-100	82-100	5-35	---	NP
Gravel Pits:											
19.											
Harjo:											
20	0-10	Clay----------	CH, CL	A-7	0	98-100	98-100	90-100	75-90	45-60	22-35
	10-36	Stratified clay to clay loam.	CH, CL	A-7	0	98-100	98-100	90-100	75-99	44-60	21-35
	36-65	Stratified clay to very fine sandy loam.	CH, CL, ML	A-7, A-6, A-4	0	98-100	98-100	85-100	51-99	30-60	9-35
Keokuk:											
21	0-65	Silt loam, loam, very fine sandy loam.	ML, CL, CL-ML	A-4	0	100	100	94-100	51-97	<30	NP-10
Kirkland:											
22	0-13	Silt loam-------	CL, ML,	A-4, A-6	0	100	100	96-100	76-98	25-40	4-19
	13-48	Silty clay, clay	CL, CH, MH	A-7	0	100	100	96-100	81-99	41-65	18-38
	48-82	Clay, silty clay, clay loam.	CL, CH, MH	A-6, A-7	0	100	100	96-100	73-99	37-65	15-38

See footnotes at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments >3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Konawa:											
23----------	0-14	Loamy fine sand	SM	A-2	0	98-100	98-100	85-100	15-35	---	NP
	14-38	Sandy clay loam, fine sandy loam.	SC, CL	A-4, A-6	0	98-100	98-100	85-100	40-60	26-40	8-18
	38-70	Fine sandy loam, sandy clay loam, loamy fine sand.	SP-SC	A-2, A-4 A-6	0	98-100	98-100	85-100	15-60	<34	NP-14
24, 25, 26--------	0-10	Fine sandy loam	SP-SM	A-4	0	98-100	98-100	90-100	40-60	<26	NP-7
	10-36	Sandy clay loam, fine sandy loam.	SC, CL	A-4, A-6	0	98-100	98-100	85-100	40-60	26-40	8-18
	36-60	Fine sandy loam, sandy clay loam, loamy fine sand.	SP-SC SM	A-4, A-6, A-2	0	98-100	98-100	85-100	15-60	21-34	NP-14
Latanier:											
27----------	0-8	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-50	11-25
	8-23	Clay, silty clay	CH, MH	A-7	0	100	100	100	95-100	51-75	25-40
	23-72	Loam, very fine sandy loam.	CL-ML, CL, ML	A-4	0	100	98-100	94-100	55-85	<30	NP-10
Lela:											
28----------	0-24	Silty clay------	CL, MH, CH	A-7	0	100	100	96-100	90-99	41-70	20-38
	24-72	Silty clay, clay	CL, MH, CH	A-7	0	100	100	96-100	90-99	41-70	20-38
Miller:											
29----------	0-12	Clay loam-------	CL, CH	A-6, A-7	0	100	98-100	96-100	80-99	35-50	16-27
	12-96	Clay------------	CL, CH	A-7	0	100	98-100	96-100	90-99	41-65	20-40
Noble:											
30----------	0-60	Fine sandy loam	ML, CL, SM, SC	A-4	0	100	98-100	94-100	36-65	<30	NP-10
Norge:											
31, 32------------	0-18	Loam, silty clay loam.	ML, CL	A-4, A-6	0	100	100	96-100	65-98	22-35	2-15
	18-60	Silty clay loam, clay loam.	CL	A-6, A-7	0	100	100	96-100	75-98	33-43	12-20
Port:											
33----------	0-30	Loam------------	ML, CL	A-4, A-6	0	100	98-100	94-100	65-98	22-37	2-14
	30-65	Silty clay loam, clay loam, loam.	ML, CL	A-4, A-6, A-7	0	100	100	96-100	65-98	27-43	8-20
134----------	0-23	Loam, fine sandy loam, silt loam	ML, CL, SM, SC	A-4, A-6	0	100	100	94-100	45-98	22-37	2-14
	23-72	Silty clay loam, clay loam, loam.	ML, CL	A-4, A-6, A-7	0	100	100	96-100	65-98	27-43	8-20

See footnotes at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments >3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Pulaski:											
35	0-18	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	95-100	90-100	36-60	<30	NP-10
	18-50	Fine sandy loam, loam.	SM, SC, ML, CL	A-4	0	100	95-100	90-100	36-60	<30	NP-10
	50-60	Loam	ML, SL, ML, CL	A-4	0	100	95-100	90-100	60-85	<30	NP-10
Renfrow:											
36, 37	0-9	Silt loam	ML, CL	A-4, A-6	0	100	100	96-100	65-97	30-37	8-14
	9-13	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	96-100	80-98	37-49	15-26
	13-75	Clay, silty clay, silty clay loam.	ML, CL, CH, MH	A-6, A-7	0	100	100	96-100	80-99	37-70	15-38
Sayers:											
38	0-16	Loamy fine sand, fine sand.	SM, SP-SM	A-2, A-3	0	100	09-100	90-100	5-35	---	NP
	16-60	Loamy fine sand	SM, SP-SM	A-2, A-3	0	100	98-100	82-100	5-35	---	NP
Seminole:											
39, 40	0-14	Loam	ML, CL, CL-ML	A-4, A-6	0	100	100	96-100	61-97	20-37	1-15
	14-20	Loam, clay loam, silt loam.	CL	A-6, A-7	0	98-100	98-100	94-100	75-98	33-43	13-20
	20-72	Clay, silty clay, clay loam.	CL, CH, ML, MH	A-7, A-6	0	98-100	98-100	94-100	75-98	37-65	15-35
Stephenville:											
41, 42	0-12	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	12-34	Fine sandy loam, sandy clay loam.	SC, CL	A-4, A-6	0	100	98-100	90-100	36-65	25-37	8-16
	34-42	Weathered bedrock.									
43:											
Stephenville part	0-12	Fine sandy loam	SM	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	12-30	Fine sandy loam, sandy clay loam.	SC, CL	A-4, A-6	0	100	98-100	90-100	36-65	25-37	8-16
	30-36	Weathered bedrock.									
Darnell part	0-5	Fine sandy loam	SM, SC, ML, CL	A-4	0-5	90-100	90-100	85-100	36-60	<30	NP-10
	5-14	Fine sandy loam, loam.	SM, SC, ML, CL	A-4	0-8	70-100	70-100	60-100	36-60	<30	NP-10
	14-18	Weathered bedrock.									
Teller:											
44	0-18	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	100	94-100	36-60	<30	NP-10
	18-36	Sandy clay loam	SC, CL	A-6, A-4	0	100	100	90-100	36-65	25-37	7-16
	36-60	Fine sandy loam	SM, SC,	A-4,	0	100	100	94-100	36-60	<30	NP-10

See footnotes at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments >3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Tribbey:											
45----------	0-10	Fine sandy loam	SM-SC, SM, CL-ML, ML	A-4	0	100	100	70-95	36-60	<26	NP-7
	10-40	Stratified fine sandy loam to loamy very fine sand.	SM-SC, SM, CL-ML, ML	A-4	0	100	98-100	80-95	40-70	<26	NP-7
	40-50	Stratified loamy fine sand to loam.	SM-SC, SM, CL-ML, ML	A-2, A-4	0	100	98-100	70-95	30-65	<26	NP-7
	50-65	Stratified clay loam to fine sandy loam.	CL-ML, CL	A-4, A-6	0	100	100	90-100	50-75	20-35	4-15
Vanoss:											
46, 47----------	0-11	Loam----------	ML, CL, CL-ML	A-4, A-6	0	100	100	96-100	55-85	22-37	2-14
	11-15	Loam, silt loam, clay loam.	CL, ML	A-4, A-6	0	100	100	96-100	65-98	22-40	2-19
	15-37	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	96-100	80-98	33-43	12-20
	37-50	Loam, silt loam, clay loam.	CL, ML	A-4, A-6, A-7	0	100	100	96-100	65-98	22-43	2-20
	50-80	Fine sandy loam, loam, clay loam.	ML, CL, SM, SC	A-4, A-6 A-7	0	100	98-100	94-100	36-98	<40	NP-20
Vernon:											
48----------	0-5	Clay loam-------	CL	A-6, A-7	0	95-100	90-100	90-100	80-98	35-50	17-30
	5-34	Clay, silty clay	CL, CH, MH	A-7	0	95-100	90-100	90-100	80-98	45-70	22-40
	34-60	Shaly clay, clay, silty clay.	CL, CH	A-6, A-7	0	90-100	85-100	65-100	65-95	30-60	15-38
49----------	0-5	Clay----------	CL, CH	A-7	0	95-100	90-100	90-100	80-98	45-70	22-40
	5-30	Clay, silty clay	CL, CH	A-7	0	95-100	90-100	90-100	80-98	45-70	22-40
	30-60	Shaly clay, silty clay, clay.	CL, CH	A-7	0	90-100	85-100	65-100	65-90	45-70	20-40
[1]50:											
Vernon part------	0-5	Clay----------	CL, CH	A-7	0	95-100	90-100	90-100	80-98	45-70	22-40
	5-30	Clay, silty clay	CL, CH	A-7	0	95-100	90-100	90-100	80-98	45-70	22-40
	30-60	Shaly clay, silty clay, clay.	CL, CH	A-7	0	90-100	85-100	65-100	65-90	45-70	20-40
Port part--------	0-24	Loam, silt loam, fine sandy loam	ML, CL, SM, SC	A-4, A-6	0	100	100	94-100	45-98	27-37	2-14
	24-60	Silty clay loam, clay loam, loam.	ML, CL	A-4, A-6, A-7	0	100	100	96-100	65-98	27-43	8-20
Weatherford:											
51, 52----------	0-12	Fine sandy loam	SM, ML, SM-SC, CL, ML	A-4	0	95-100	95-100	75-90	36-60	<25	NP-7
	12-18	Sandy clay loam	CL, SC	A-6	0	95-100	95-100	80-100	36-60	30-40	15-24
	18-52	Sandy clay loam, fine sandy loam	SC, CL	A-4, A-6	0	95-100	95-100	80-100	40-65	20-40	8-20
	52-60	Weathered bedrock.									

See footnotes at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments >3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Weatherford:											
[1]53----------	0-5	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4	0	95-100	95-100	75-90	36-60	<25	NP-7
	5-24	Sandy clay loam	CL, SC	A-6	0	95-100	95-100	80-100	36-60	30-40	15-24
	24-58	Sandy clay loam, fine sandy loam	SC, CL	A-4, A-6	0	95-100	95-100	80-100	40-65	20-40	8-20
	58-62	Weathered bedrock.									
Stephenville part	0-6	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4	0	95-100	95-100	75-90	36-60	<25	NP-7
	6-28	Fine sandy loam, sandy clay loam.	SC, CL	A-4, A-6	0	100	98-100	90-100	36-65	25-37	7-16
	28-38	Weathered bedrock.									
Windthorst:											
54----------	0-10	Fine sandy loam	SM, ML, SM-SC,	A-4	0	95-100	95-100	75-100	36-60	<25	3-7
	10-45	Clay, sandy clay	CH, CL	A-7, A-6	0	95-100	95-100	85-100	51-90	35-55	15-3
	45-60	Weathered bedrock.									
Yahola:											
55----------	0-11	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	95-100	90-100	36-85	<30	NP-10
	11-40	Fine sandy loam, loam.	SM, SC, ML, CL	A-4	0	100	95-100	90-100	36-85	<30	NP-10
	40-72	Fine sandy loam, loam, loamy fine sand.	SM, SC, ML, CL	A-4, A-2	0	100	95-100	90-100	15-85	<30	NP-10
Zaneis:											
56, 57----------	0-9	Loam----------	ML, CL-ML	A-4	0	100	100	94-100	60-70	<26	NP-6
	9-52	Loam, clay loam, sandy clay loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0	100	100	90-100	36-90	25-40	7-18
	52-60	Weathered bedrock.									

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[Dashes indicate data were not available. The symbol < means less than; > means greater than. The erosion tolerance factor (T) is for the entire profile. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
						Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH						
Asher:										
1----------	0-21	0.06-0.2	0.18-0.22	6.1-8.4	Moderate	High-----	Low------	0.37	5	---
	21-65	0.6-2.0	0.13-0.24	7.4-8.4	Low-------	Low------	Low------	0.43		
Aydelotte:										
2----------	0-6	0.6-2.0	0.15-0.20	6.1-7.3	Low-------	Low------	Low------	0.49	4	---
	6-63	<0.06	0.12-0.18	6.1-8.4	High------	High-----	Low------	0.37		
3----------	0-4	0.2-0.6	0.15-0.20	6.1-7.3	Moderate	Moderate	Low------	0.43	4	---
	4-63	<0.06	0.12-0.18	6.1-8.4	High------	High-----	Low------	0.37		
Borrow Pits:										
4.										
Carytown:										
5----------	0-11	0.6-2.0	0.16-0.24	5.6-7.3	Low-------	Moderate	Low------	0.43	3	---
	11-70	<0.06	0.09-0.13	6.1-8.4	High------	High-----	Low------	0.49		
Chickasha:										
6, 7----------	0-14	2.0-6.0	0.13-0.17	5.6-7.3	Low-------	Low------	Moderate	0.28	4	---
	14-36	0.6-2.0	0.14-0.18	5.6-7.3	Low-------	Moderate	Moderate	0.28		
	36-53	0.6-2.0	0.13-0.17	5.6-8.4	Low-------	Moderate	Moderate	0.28		
	53-65									
[1]8:										
Chickasha part---	0-12	2.0-6.0	0.13-0.17	5.6-7.3	Low-------	Low------	Moderate	0.28	4	---
	12-30	0.6-2.0	0.14-0.18	5.6-7.3	Low-------	Moderate	Moderate	0.28		
	30-42	0.6-2.0	0.13-0.17	5.6-8.4	Low-------	Moderate	Moderate	0.28		
	42-50									
Zaneis part------	0-7	0.6-2.0	0.11-0.20	5.6-6.5	Low-------	Low------	Low------	0.28	4	---
	7-45	0.2-0.6	0.12-0.20	5.6-7.8	Moderate	Moderate	Low------	0.32		
	45-55	0.2-2.0	0.11-0.20	6.1-7.8	Moderate	Moderate	Low------	0.32		
	55-60									
Chigley:										
[1]9----------	0-16	2.0-6.0	0.09-0.13	5.6-7.3	Low-------	Moderate	Low------	0.37	4	---
	16-42	0.2-0.6	0.14-0.18	5.1-7.8	Moderate	High-----	Moderate	0.28		
	42-60	0.2-0.6	0.12-0.16	7.9-8.4	Moderate	High-----	Moderate	0.28		
Dougherty:										
10, 11----------	0-23	2.0-6.0	0.07-0.11	5.6-6.5	Low-------	Low------	Moderate	0.20	5	2
	23-40	0.6-2.0	0.11-0.17	5.1-6.0	Low-------	Low------	Moderate	0.32		
	40-60	0.6-2.0	0.11-0.17	5.1-7.3	Low-------	Low------	Moderate	0.32		
	60-72	2.0-6.0	0.07-0.11	5.1-7.3	Low-------	Low------	Moderate	0.24		
Eufaula:										
12, 13----------	0-72	6.0-20.0	0.05-0.11	5.1-7.3	Low-------	Low------	Moderate	0.17	5	1
Fluvents:										
14----------	0-60	0.6-2.0	0.11-0.24	7.9-8.4	Low-------	Low------	Low------	0.37	5	---
Gaddy:										
15----------	0-8	6.0-20	0.07-0.11	7.4-8.4	Low-------	Low------	Low------	0.17	5	2
	8-60	6.0-20	0.06-0.10	7.9-8.4	Low-------	Low------	Low------	0.17		
Galey:										
16----------	0-12	2.0-6.0	0.11-0.15	5.1-6.5	Low-------	Low------	Moderate	0.24	5	---
	12-65	0.6-2.0	0.13-0.17	5.1-6.5	Low-------	Moderate	Moderate	0.32		
Gracemont:										
17----------	0-10	0.6-6.0	0.11-0.14	7.4-8.4	Low-------	Moderate	Low------	0.32	5	---
	10-60	2.0-6.0	0.11-0.20	7.9-8.4	Low-------	Moderate	Low------	0.32		
Gracemore:										
18----------	0-10	2.0-6.0	0.05-0.11	7.4-8.4	Low-------	Low------	Low------	0.17	5	---
	10-72	2.0-6.0	0.05-0.11	7.9-8.4	Low-------	Low------	Low------	0.17		
Gravel Pits:										
19.										

See footnotes at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
						Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH						
Harjo:										
20	0-10	<0.06	0.14-0.18	7.4-8.4	High	High	Low	0.37	5	---
	10-36	<0.06	0.14-0.18	7.9-8.4	High	High	Low	0.37		
	36-65	0.06-2.0	0.10-0.18	7.9-8.4	High	High	Low	0.37		
Keokuk:										
21	0-65	0.6-2.0	0.15-0.20	6.1-8.4	Low	Low	Low	0.37	5	---
Kirkland:										
22	0-13	0.6-2.0	0.15-0.24	6.1-7.3	Low	Low	Low	0.43	5	---
	13-48	<0.06	0.12-0.18	6.6-7.8	High	High	Low	0.37		
	48-82	0.2-0.6	0.12-0.22	7.9-8.4	High	High	Low	0.37		
Konawa:										
23	0-14	6.0-20.0	0.06-0.10	5.6-6.5	Low	Low	Moderate	0.17	5	2
	14-38	0.6-2.0	0.12-0.16	5.1-6.0	Low	Moderate	Moderate	0.32		
	38-70	2.0-20.0	0.07-0.17	5.1-7.3	Low	Low	Moderate	0.24		
24, 25, 26	0-10	2.0-6.0	0.11-0.15	5.6-6.5	Low	Low	Moderate	0.24	5	---
	10-36	0.6-2.0	0.12-0.16	5.1-6.0	Low	Moderate	Moderate	0.32		
	36-60	2.0-20.0	0.07-0.15	5.1-7.3	Low	Low	Moderate	0.24		
Latanier:										
27	0-8	0.06-0.2	0.20-0.22	6.6-8.4	Moderate	High	Low	0.37	5	---
	8-23	<0.06	0.14-0.18	7.4-8.4	Very high	High	Low	0.37		
	23-72	0.06-2.0	0.18-0.20	7.9-8.4	Moderate	High	Low	0.37		
Lela:										
28	0-24	<0.06	0.12-0.18	6.1-7.8	High	High	Low	0.37	4	---
	24-72	<0.06	0.12-0.18	7.9-8.4	High	High	Low			
Miller:										
29	0-12	0.06-0.2	0.16-0.20	7.4-8.4	High	High	Low	0.37	5	---
	12-96	<0.06	0.15-0.19	7.4-8.4	High	High	Low	0.37		
Noble:										
30	0-60	2.0-6.0	0.11-0.15	5.6-6.5	Low	Low	Low	0.24	5	---
Norge:										
31, 32	0-18	0.6-2.0	0.15-0.24	5.6-7.3	Low	Moderate	Low	0.32	5	---
	18-60	0.2-0.6	0.15-0.22	5.6-8.4	Moderate	Moderate	Low	0.32		
Port:										
33	0-30	0.6-2.0	0.15-0.20	5.6-7.8	Low	Low	Low	0.32	5	---
	30-65	0.6-2.0	0.15-0.24	6.1-8.4	Moderate	Moderate	Low	0.32		
[1]34	0-23	0.6-2.0	0.15-0.24	5.6-7.8	Low	Low	Low	0.32	5	---
	23-72	0.6-2.0	0.15-0.24	6.1-8.4	Moderate	Moderate	Low	0.32		
Pulaski:										
35	0-18	2.0-6.0	0.12-0.16	5.6-7.3	Low	Low	Moderate	0.20	5	---
	18-50	2.0-6.0	0.12-0.16	5.6-7.8	Low	Low	Moderate			
	50-60	2.0-6.0	0.07-0.16	6.6-7.8	Low	Low	Low			
Renfrow:										
36, 37	0-9	0.6-2.0	0.15-0.24	6.1-7.3	Low	Low	Low	0.37	5	---
	9-13	0.2-0.6	0.15-0.22	6.1-7.3	Moderate	Moderate	Low			
	13-75	<0.06	0.12-0.22	6.1-8.4	High	High	Low			
Sayers:										
[1]38	0-16	2.0-20.0	0.07-0.10	6.6-7.8	Low	Low	Low	0.17	5	2
	16-60	2.0-20.0	0.05-0.10	7.4-7.8	Low	Low	Low	0.17		
Seminole:										
39, 40	0-14	0.6-2.0	0.15-0.20	5.6-7.3	Low	Moderate	Moderate	0.43	5	---
	14-20	0.2-0.6	0.15-0.20	5.6-7.3	Moderate	Moderate	Moderate	0.37		
	20-72	0.06-0.2	0.15-0.20	5.6-8.4	High	High	Moderate	0.32		

See footnotes at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
						Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH						
Stephenville:										
41, 42	0-12	2.0-6.0	0.11-0.15	5.1-6.5	Low	Low	Moderate	0.24	3	---
	12-34	0.6-2.0	0.11-0.17	5.1-6.0	Low	Moderate	Moderate	0.32		
	34-42									
[1]43:										
Stephenville part	0-12	2.0-6.0	0.11-0.15	5.1-6.5	Low	Low	Moderate	0.24	3	
	12-30	0.6-2.0	0.11-0.17	5.1-6.0	Low	Moderate	Moderate	0.32		
	30-36									
Darnell part	0-5	2.0-6.0	0.12-0.16	5.1-7.3	Low	Low	Moderate	0.24	2	---
	5-14	2.0-6.0	0.12-0.16	5.1-7.3	Low	Low	Moderate	0.24		
	14-18									
Teller:										
44	0-18	2.0-6.0	0.12-0.15	5.6-6.5	Low	Low	Moderate	0.28	5	---
	18-36	0.6-2.0	0.14-0.18	5.6-6.5	Low	Low	Moderate	0.32		
	36-60	2.0-6.0	0.13-0.15	5.6-7.3	Low	Low	Moderate	0.20		
Tribbey:										
45	0-10	2.0-6.0	0.11-0.15	5.6-8.4	Low	Moderate	Low	0.20	5	---
	10-40	2.0-6.0	0.11-0.16	5.6-8.4	Low	Moderate	Low	0.20		
	40-50	2.0-6.0	0.10-0.15	5.6-8.4	Low	Moderate	Low	0.20		
	50-65	0.6-6.0	0.14-0.20	6.6-8.4	Low	High	Low	0.32		
Vanoss:										
46, 47	0-11	0.6-2.0	0.15-0.20	5.1-6.5	Low	Low	Low	0.32	5	---
	11-15	0.6-2.0	0.16-0.21	5.6-6.5	Low	Low	Low	0.37		
	15-37	0.6-2.0	0.17-0.22	5.6-6.5	Moderate	Moderate	Moderate	0.32		
	37-50	0.6-2.0	0.16-0.21	5.6-7.3	Low	Moderate	Moderate	0.37		
	50-80	0.6-2.0	0.13-0.21	5.6-7.3	Low	Moderate	Moderate	0.32		
Vernon:										
48	0-5	0.06-0.2	0.13-0.17	7.4-8.4	High	High	Low	0.37	2	---
	5-34	<0.06	0.13-0.17	7.9-8.4	High	High	Low	0.37		
	34-60	<0.06	0.08-0.10	7.9-8.4	High	High	Low			
49	0-5	<0.06	0.13-0.17	7.4-8.4	High	High	Low	0.37	2	---
	5-30	<0.06	0.13-0.17	7.9-8.4	High	High	Low	0.37		
	30-60	<0.06	0.08-0.10	7.9-8.4	High	High	Low			
[1]50:										
Vernon part	0-5	<0.06	0.13-0.17	7.4-8.4	High	High	Low	0.37	2	---
	5-30	<0.06	0.13-0.17	7.9-8.4	High	High	Low	0.37		
	30-60	<0.06	0.08-0.10	7.9-8.4	High	High	Low			
Port part	0-24	0.6-2.0	0.15-0.24	5.6-7.8	Moderate	Moderate	Low	0.32	5	---
	24-60	0.6-2.0	0.15-0.24	6.1-8.4	Moderate	Moderate	Low	0.32		
Weatherford:										
51, 52	0-12	2.0-6.0	0.11-0.15	6.1-7.3	Low	Low	Low	0.43	3	---
	12-18	0.6-2.0	0.12-0.16	5.6-6.5	Low	Low	Moderate	0.49		
	18-52	0.6-2.0	0.10-0.15	5.6-6.5	Low	Low	Moderate	0.49		
	52-60									
[1]53:										
Weatherford part	0-5	2.0-6.0	0.11-0.15	6.1-7.3	Low	Low	Low	0.43	3	---
	5-24	0.6-2.0	0.12-0.16	5.6-6.3	Low	Low	Moderate	0.49		
	24-58	0.6-2.0	0.10-0.15	5.6-6.5	Low	Low	Moderate	0.49		
	58-62									
Stephenville part	0-6	2.0-6.0	0.11-0.15	5.1-6.5	Low	Low	Moderate	0.24	3	---
	6-28	0.6-2.0	0.11-0.17	5.1-6.0	Low	Moderate	Moderate	0.32		
	28-38									

See footnotes at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
						Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH						
Windthorst:										
54----------	0-10	0.6-2.0	0.11-0.15	5.6-7.3	Low-------	Low------	Low------	0.49	5	---
	10-30	0.2-0.6	0.15-0.20	5.6-6.5	Moderate	High-----	Low------	0.37		
	30-45	0.2-0.6	0.15-0.20	5.6-8.4	Moderate	Moderate	Low------	0.37		
	45-60									
Yahola:										
55----------	0-12	2.0-6.0	0.12-0.16	7.9-8.4	Low-------	Low------	Low------	0.24	5	3
	12-60	2.0-6.0	0.12-0.16	7.9-8.4	Low-------	Low------	Low------	0.24		
Zaneis:										
56, 57----------	0-9	0.6-2.0	0.11-0.20	5.6-6.5	Low-------	Low------	Low------	0.28	4	---
	9-52	0.2-0.6	0.12-0.20	5.6-7.8	Moderate	Moderate	Low------	0.32		
	52-60									

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 17.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. The symbol < means less than; > means greater than]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
Asher: 1	C	Rare	Very brief	Mar-Aug	>6.0	---	---	>60	---
Aydelotte: 2, 3	D	None	---	---	>6.0	---	---	>60	---
Borrow Pits:									
Carytown: 5	D	None	---	---	1.0	Perched	Mar-May	>60	--
Chickasha: 6, 7	B	None	---	---	>6.0	---	---	40-60	Rippable
18: Chickasha part	B	None	---	---	>6.0	---	---	40-60	Rippable
Zaneis part	B	None	---	---	>6.0	---	---	40-60	Rippable
Chigley: 19	C	None	---	---	3.0	Perched	Feb-May	40-70	Rippable
Dougherty: 10, 11	A	None	---	---	>6.0	---	---	>60	---
Eufaula: 12, 13	A	None	---	---	>6.0	---	---	>60	---
Fluvents: 14	B	Occasional	Very brief	Apr-Oct	>6.0	---	---	>60	---
Gaddy: 15	A	Occasional	Very brief	Mar-Aug	>6.0	---	---	>60	---
Galey: 16	B	None	---	---	4.0-6.0	Perched	Mar-May	>60	---
Gracemont: 17	B	Frequent	Very brief to brief.	Mar-Aug	0.5-3.0	Apparent	Nov-May	>60	---
Gracemore: 18	C	Frequent	Very brief	Apr-Aug	0.5-3.0	Apparent	Nov-May	>60	---
Gravel Pits: 19.									
Harjo: 20	D	Frequent	Very long	Oct-Jun	1.0	Apparent	Oct-Jun	>60	---
Keokuk: 21	B	Rare	Very brief	Mar-Aug	>6.0	---	---	>60	---
Kirkland: 22	D	None	---	---	>6.0	---	---	>60	---
Konawa: 23, 24, 25, 26	B	None	---	---	>6.0	---	---	>60	---
Latanier: 27	D	Occasional	Brief	Nov-May	2.0-3.0	Apparent	Dec-Apr	>60	---

See footnotes at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
Lela: 28	D	Occasional	Very brief	Apr-Oct	>6.0	---	---	>60	---
Miller: 29	D	Occasional	Brief	Mar-May	>6.0	---	---	>60	---
Noble: 30	B	None	---	---	>6.0	---	---	>60	---
Norge: 31, 32	B	None	---	---	>6.0	---	---	>60	---
Port: 33	B	Occasional	Very brief to brief.	Mar-Aug	>6.0	---	---	>60	---
[1]34	B	Frequent	Very brief to brief.	Mar-Aug	>6.0	---	---	>60	---
Pulaski: 35	B	Occasional	Very brief	Mar-Aug	>6.0	---	---	>60	---
Renfrow: 36, 37	D	None	---	---	>6.0	---	---	>60	---
Sayers: [1]38	A	Occasional	Very brief	Mar-Aug	>5.0	Apparent	Oct-May	>60	---
Seminole: 39, 40	C	None	---	---	2.0-3.0	Perched	Apr-May	>60	---
Stephenville: 41, 42	B	None	---	---	>6.0	---	---	20-40	Rippable
[1]43: Stephenville part	B	None	---	---	>6.0	---	---	20-40	Rippable
Darnell part	C	None	---	---	>6.0	---	---	10-20	Rippable
Teller: 44	B	None	---	---	>6.0	---	---	>60	---
Tribbey: 45	B	Frequent	Brief	Jan-Dec	1.5-3.0	Apparent	Oct-May	>60	---
Vanoss: 46, 47	B	None	---	---	>6.0	---	---	>60	---
Vernon: 48, 49	D	None	---	---	>6.0	---	---	>60	---
[1]50: Vernon part	D	None	---	---	>6.0	---	---	>60	---
Port part	B	Frequent	Very brief to brief.	Mar-Aug	>6.0	---	---	>60	---
Weatherford: 51, 52	B	None	---	---	>6.0	---	---	40-60	Rippable

See footnotes at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
Weatherford: [1]53:									
Weatherford part	B	None	---	---	>6.0	---	---	20-40	Ripable.
Stephenville part	B	None	---	---	>6.0	---	---	20-40	Ripable
Windthorst: 54	C	None	---	---	>6.0	---	---	40-50	Ripable
Yahola: 55	B	Occasional	Very brief	Mar-Aug	>6.0	---	---	>60	---
Zaneis: 56, 57	B	None	---	---	>6.0	---	---	40-60	Ripable

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 18.--ENGINEERING TEST DATA

[Tests performed by the Oklahoma Department of Highways in accordance with standard procedures of the American Association of State Highway and Transportation Officials (AASHTO) (1). NP means nonplastic]

Soil name and location	Report number	Depth	Mechanical analysis[1]									Liquid limit[2]	Plasticity index[3]	Classification	
			Shrinkage limit	Shrinkage ratio	Volume change	Percentage passing sieve number--			Percentage smaller than--					AASHTO[4]	Unified 5/
						10	40	200	0.05 mm	0.02 mm	0.005 mm				
Carytown silt loam:	63-386	0-11	11	1.95	39	100	100	82	68	27	20	35	18	A-6(11)	CL
About 1,100 feet south and 100 feet	63-387	13-30	9	2.05	63	100	99	82	77	48	40	49	29	A-7-6(17)	CL
west of the NE. corner sec. 17,	63-388	45-60+	7	2.10	64	100	100	86	78	47	40	48	29	A-7-6(17)	CL
T. 6 N., R. 3 E.															
Gaddy loamy fine sand:	63-393	0-7	NP	NP	NP	100	100	33	14	5	4	NP	NP	A-2-3(0)	SM
About 50 feet north of the south	63-394	7-60+	NP	NP	NP	100	100	36	17	4	3	NP	NP	A-4(0)	SM
quarter corner sec. 21, T. 10 N.,															
R. 4 R.															
Harjo clay:	63-430	0-6	11	1.94	54	100	99	98	97	55	44	44	21	A-7-6(13)	CL
About 800 feet north of the south	63-431	6-60	10	2.02	53	100	99	99	96	55	46	43	23	A-7-6(14)	CL
quarter corner sec. 7, T. 7 N.,															
R. 5 E.															
Keokuk silt loam:	63-400	0-11	16	1.74	12	100	100	94	75	20	15	24	5	A-4(8)	CL-ML
About 800 feet east and 50 feet	63-401	11-22	NP	NP	NP	100	100	69	45	13	11	NP	NP	A-4(7)	ML
south of the north quarter corner	63-403	47-60	NP	NP	NP	100	100	89	71	14	12	NP	NP	A-4(8)	ML
sec. 18, T. 10 N., R. 5 E.															
Kirkland silt loam:	63-440	0-9	17	1.74	12	100	99	76	63	18	13	25	4	A-4(8)	ML-CL
About 1,400 feet north and 50 feet	63-441	9-18	9	2.03	77	100	100	90	83	49	42	52	29	A-7-6(18)	CH
east of the SW. corner sec. 7	63-442	18-30	7	2.15	83	100	100	87	82	51	45	52	31	A-7-6(18)	CH
T. 11 N., E. 4 E.	63-443	30-42	7	2.14	75	100	100	81	75	49	43	49	29	A-7-6(18)	CL
	63-445	54-64	8	2.08	54	100	99	73	64	42	37	41	24	A-7-6(13)	CL
Konawa fine sandy loam:	63-432	0-9	NP	NP	NP	100	99	54	42	12	7	NP	NP	A-4(4)	ML
About 1,000 feet north and 50 feet	63-434	14-40	12	1.93	25	100	99	54	45	24	21	27	13	A-6(5)	CL
west of the SE. corner sec. 33,	63-435	40-54	13	1.83	11	100	99	39	32	19	16	24	8	A-4(1)	SC
T. 6 N., R. 5 E.	63-436	54-60	16	1.78	6	100	100	23	26	15	14	22	4	A-2(0)	SC-SM
Lela silty clay:	63-461	0-10	11	1.95	73	100	100	97	90	56	46	56	29	A-7-6(19)	CH
About 1,100 feet south and 50 feet	63-462	28-45	11	1.94	92	100	100	99	98	73	58	71	39	A-7-5(20)	CH-MH
south of the north quarter corner															
sec. 21, T. 10 N., R. 4 E.															
Renfrow loam:	63-389	0-8	14	1.83	32	100	98	69	57	30	24	37	16	A-6(9)	CL
About 400 feet east and 50 feet	63-391	13-28	9	2.04	68	100	99	82	75	53	45	50	25	A-7-6(16)	CL
south of the north quarter corner	63-392	28-60+	5	2.23	78	100	99	89	85	62	52	52	29	A-7-6(18)	CH
sec. 17, T. 6 N., R. 5 E.															

See footnotes at end of table.

TABLE 18.--ENGINEERING TEST DATA--Continued

Soil name and location	Report number	Depth	Mechanical analysis[1]									Liquid limit[2]	Plasticity index[3]	Classification	
			Shrinkage limit	Shrinkage ratio	Volume change	Percentage passing sieve number--			Percentage smaller than--					AASHTO[4]	Unified[5]
						10	40	200	0.05 mm	0.02 mm	0.005 mm				
Seminole loam:															
About 100 feet east and 25 feet	63-404	0-15	17	1.72	15	100	99	61	51	17	12	28	6	A-4{5}	ML-CL
south of the NW corner sec. 16,	63-406	19-34	9	2.02	62	100	100	79	67	44	40	47	25	A-7-6(15)	CL
R. 10 N., R. 5 E.	63-407	34-48	9	2.02	57	100	99	76	66	42	40	45	25	A-7-6(15)	CL
	63-408	48-60	12	1.96	51	100	99	75	64	42	39	46	27	A-7-6(16)	CL
Vernon clay:															
About 50 feet east and 50 feet	63-422	0-5	9	1.97	75	100	99	98	96	65	53	56	28	A-7-6(18)	MH-CH
north of the SW. corner sec. 9,	63-424	12-30	7	2.14	91	100	99	89	83	53	45	62	37	A-7-6(20)	CH
T. 8 N., R. 4 E.															
Yahola fine sandy loam:															
About 400 feet north and 200 feet	63-478	0-12	NP	NP	NP	100	100	30	23	12	9	NP	NP	A-2-3(0)	SM
west of the SE. corner sec. 28,	63-479	12-60	NP	NP	NP	100	99	33	24	14	12	NP	NP	A-2-3(0)	SM
T. 8 N., R. 4 E.															

[1]Mechanical analyses according to AASHTO Designation T 88-57 (1). Results by this procedure may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservvation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters is excluded from calculations of grain-size fractions.

[2]Based on AASHTO Designation T 89-60 (1).

[3]Based on AASHTO Designation T 90-56 and AASHTO Designation T 91-54 (1).

[4]Based on standard specifications for highway material and methods of sampling and testing: The classification of soils and soil-aggregate mixtures for highway construction purposes, AASHTO designation M 145-49. Oklahoma Department of Highways classification procedure further subdivides the AASHTO A-2-4 subgroup as follows: A-2-3(0) when P1 = nonplastic; A-2(0) when P1 = NP to 5; and A-2-4(0) when P1 = 5 to 10.

[5]Based on ASTM Designation D 2487-66 T (2).

TABLE 19.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Asher	Fine-silty, mixed, thermic Fluventic Haplustolls
Aydelotte	Fine, mixed, thermic Udertic Paleustalfs
Carytown	Fine, mixed, thermic Albic Natraqualfs
Chickasha	Fine-loamy, mixed, thermic Udic Argiustolls
Chigley	Fine, mixed, thermic Udic Paleustalfs
Darnell	Loamy, siliceous, thermic, shallow Udic Ustochrepts
Dougherty	Loamy, mixed, thermic Arenic Haplustalfs
Eufaula	Sandy, siliceous, thermic Psammentic Paleustalfs
Gaddy	Sandy, mixed, thermic Typic Ustifluvents
Galey	Fine-loamy, mixed, thermic Ultic Paleustalfs
Gracemont	Coarse-loamy, mixed (calcareous), thermic Aquic Udifluvents
Gracemore	Sandy, mixed, thermic Aquic Udifluvents
Harjo	Fine, mixed (calcareous), thermic Typic Fluvaquents
Keokuk	Coarse-silty, mixed, thermic Fluventic Haplustolls
Kirkland	Fine, mixed, thermic Udertic Paleustolls
Konawa	Fine-loamy, mixed, thermic Ultic Haplustalfs
Latanier	Clayey over loamy, mixed, thermic Vertic Hapludolls
Lela	Fine, mixed, thermic Typic Chromuderts
Miller	Fine, mixed, thermic Vertic Haplustolls
Noble	Coarse-loamy, siliceous, thermic Udic Ustochrepts
Norge	Fine-silty, mixed, thermic Udic Paleustolls
Port	Fine-silty, mixed, thermic Cumulic Haplustolls
Pulaski	Coarse-loamy, mixed, nonacid, thermic Typic Ustifluvents
Renfrow	Fine, mixed, thermic Udertic Paleustolls
Sayers	Sandy, mixed, thermic Typic Ustifluvents
Seminole	Fine, mixed, thermic Glossic Natrustolls
Stephenville	Fine-loamy, siliceous, thermic Ultic Haplustalfs
Teller	Fine-loamy, mixed, thermic Udic Argiustolls
Tribbey	Coarse-loamy, mixed, nonacid, thermic Aquic Udifluvents
Vanoss	Fine-silty, mixed, thermic Udic Argiustolls
Vernon	Fine, mixed, thermic Typic Ustochrepts
Weatherford	Fine-loamy, siliceous, thermic Ultic Haplustalfs
Windthorst	Fine, mixed, thermic Udic Paleustalfs
Yahola	Coarse-loamy, mixed (calcareous), thermic Typic Ustifluvents
Zaneis	Fine-loamy, mixed, thermic Udic Argiustolls

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
OKLAHOMA AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

POTTAWATOMIE COUNTY
OKLAHOMA

Scale 1:190,080

1 0 1 2 3 4 Miles

N

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SOIL ASSOCIATIONS

1 PORT–YAHOLA–KEOKUK association: Deep, nearly level through very gently sloping, well drained, loamy soils on flood plains.

2 WEATHERFORD–CHICKASHA association: Deep, very gently sloping through sloping, well drained, loamy soils on uplands.

3 KONAWA–EUFAULA association: Deep, nearly level through strongly sloping, well drained or somewhat excessively drained, sandy or loamy soils on uplands.

4 AYDELOTTE–RENFROW–ZANEIS association: Deep, very gently sloping through sloping, well drained, loamy soils on uplands.

5 STEPHENVILLE–DARNELL association: Moderately deep or shallow, very gently sloping through strongly sloping, well drained or somewhat excessively drained, loamy soils on uplands.

6 VERNON association: Deep, gently sloping through strongly sloping, well drained, clayey or loamy soils on uplands.

7 SEMINOLE–CHICKASHA–AYDELOTTE association: Deep, nearly level through sloping, moderately well drained or well drained, loamy soils on uplands.

Compiled 1977

INDEX TO MAP SHEETS
POTTAWATOMIE COUNTY
OKLAHOMA

Scale 1:190,080

1 0 1 2 3 4 Miles

N

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Inset, sheet 13

Inset, sheet 66

SOIL LEGEND

SYMBOL	NAME
1	Asher silty clay loam
2	Aydelotte loam, 2 to 5 percent slopes
3	Aydelotte clay loam, 3 to 6 percent slopes, severely eroded
4	Borrow Pits
5	Carytown silt loam, 0 to 1 percent slopes
6	Chickasha loam, 1 to 3 percent slopes
7	Chickasha loam, 3 to 5 percent slopes
8	Chickasha and Zaneis soils, 1 to 8 percent slopes, severely eroded
9	Chigley complex, 3 to 12 percent slopes
10	Dougherty loamy fine sand, 0 to 3 percent slopes
11	Dougherty loamy fine sand, 3 to 8 percent slopes
12	Eufaula fine sand, 0 to 3 percent slopes
13	Eufaula fine sand, 3 to 12 percent slopes
14	Fluvents, 8 to 15 percent slopes
15	Gaddy loamy fine sand
16	Galey fine sandy loam, 0 to 2 percent slopes
17	Gracemont fine sandy loam
18	Gracemore fine sand
19	Gravel Pits
20	Harjo clay
21	Keokuk silt loam
22	Kirkland silt loam, 0 to 1 percent slopes
23	Konawa loamy fine sand, 3 to 8 percent slopes
24	Konawa fine sandy loam, 0 to 3 percent slopes
25	Konawa fine sandy loam, 3 to 5 percent slopes
26	Konawa fine sandy loam, 3 to 8 percent slopes, severely eroded
27	Latanier silty clay loam
28	Lela silty clay
29	Miller clay loam
30	Noble fine sandy loam, 3 to 8 percent slopes
31	Norge loam, 1 to 3 percent slopes
32	Norge loam, 3 to 5 percent slopes
33	Port loam
34	Port soils
35	Pulaski fine sandy loam
36	Renfrow silt loam, 1 to 3 percent slopes
37	Renfrow silt loam, 3 to 5 percent slopes
38	Sayers complex
39	Seminole loam, 0 to 2 percent slopes
40	Seminole loam, 2 to 5 percent slopes
41	Stephenville fine sandy loam, 1 to 3 percent slopes
42	Stephenville fine sandy loam, 3 to 5 percent slopes
43	Stephenville-Darnell complex, 5 to 12 percent slopes
44	Teller fine sandy loam, 3 to 5 percent slopes
45	Tribbey fine sandy loam
46	Vanoss loam, 0 to 1 percent slopes
47	Vanoss loam, 1 to 3 percent slopes
48	Vernon clay loam, 3 to 5 percent slopes
49	Vernon clay, 5 to 12 percent slopes
50	Vernon-Port complex
51	Weatherford fine sandy loam, 1 to 3 percent slopes
52	Weatherford fine sandy loam, 3 to 5 percent slopes
53	Weatherford and Stephenville soils, 3 to 8 percent slopes, severely eroded
54	Windthorst fine sandy loam, 1 to 5 percent slopes
55	Yahola fine sandy loam
56	Zaneis loam, 1 to 3 percent slopes
57	Zaneis loam, 3 to 5 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool (Davis Airstrip; FLOOD POOL LINE)

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate (79)
- Federal (410)
- State (52)
- County, farm or ranch (378)

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small (water; w)

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (GAS)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial (water; w)
- Intermittent (int; i)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot
- Sewage lagoon (S. L.)

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS (CeA; FoB2)

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 1

LINCOLN COUNTY

2 260 000 FEET

R. 2 E.

OKLAHOMA COUNTY

775 000 FEET

T. 11 N.

CHICAGO, ROCK ISLAND AND PACIFIC

KISHKETON LAKE

NORTH CANADIAN RIVER

McLoud

CHICAGO, ROCK ISLAND AND PACIFIC

2 275 000 FEET

765 000 FEET

(Joins sheet 2)

(Joins sheet 8)

1

N

1 Mile

5000 Feet

Scale 1:20000

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 2

(2)

N

R. 2 E. | R. 3 E.

LINCOLN COUNTY

2 300 000 FEET

765 000 FEET

T. 11 N.

1 Mile

5000 Feet

Scale 1 : 20000

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000

water

Brush Creek

Hazel Dell

CANADIAN RIVER

NORTH

(Joins sheet 1)

(Joins sheet 3)

(Joins sheet 9)

2 280 000 FEET

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 3

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 4

(4)

N

LINCOLN COUNTY R. 4 E.

2 350 000 FEET

765 000 FEET

775 000 FEET

T. 11 N.

(Joins sheet 3)

(Joins sheet 5)

2 330 000 FEET

(Joins sheet 11)

Squaw Creek

NORTH CANADIAN RIVER

1 Mile

5000 Feet

Scale · 1:20000

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 5

5

N

2 355 000 FEET

R. 5 E.

LINCOLN COUNTY

775 000 FEET

T. 11 N.

Bellemont

Garden Grove

(Joins sheet 4)

(Joins sheet 6)

(Joins sheet 12)

765 000 FEET

water

Dunn Creek

Painter Creek

Stump Creek

North Canadian River

1 Mile

5,000 Feet

Scale 1:20000

6

N

1 Mile 5000 Feet

0 0 ¼ 1000 ½ 2000 ¾ 3000 1 4000 5000

Scale 1:20000

R. 5 E. | R. 6 E.

LINCOLN COUNTY

2 395 000 FEET

775 000 FEET

T. 11 N.

(Joins sheet 7)

(Joins sheet 5)

765 000 FEET

water

Shan Creek

Centerview

SEMINOLE COUNTY

CANADIAN RIVER

NORTH 1ST

2 375 000 FEET

(Joins sheet 13)

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 7

7

N

2 400 000 FEET

R. 6 E.

LINCOLN COUNTY

775 000 FEET

T. 11 N.

(Joins sheet 6)

Centerview

OKFUSKEE COUNTY

2 415 000 FEET

765 000 FEET

(Joins inset, sheet 13)

1 Mile

5 000 Feet

Scale 1:20000

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(8)

N

(Joins sheet 1)

R. 2 E.

2 275 000 FEET

760 000 FEET

T. 11 N.

(Joins sheet 9)

1 Mile

5 000 Feet

Scale 1:20000

POTTAWATOMIE COUNTY
OKLAHOMA

745 000 FEET

2 260 000 FEET

(Joins sheet 14)

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Coordinate grid 1000 and land division corners are shown where accurately positioned

N

2 280 000 FEET

760 000 FEET

R. 2 E. | R. 3 E.

(Joins sheet 2)

T. 11 N.

(Joins sheet 8)

(Joins sheet 10)

(Joins sheet 15)

2 300 000 FEET

745 000 FEET

1 Mile

5000 Feet

Scale · 1:20000

NORTH CANADIAN

ROCK ISLAND AND PACIFIC RAILROAD

ATCHISON TOPEKA AND SANTA FE

North Deer Creek

Dale

Clarks Heights

water

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POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 10

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 11

11

N

2 330 000 FEET

760 000 FEET

R. 4 E.

(Joins sheet 4)

T. 11 N.

(Joins sheet 10)

(Joins sheet 12)

(Joins sheet 17)

2 350 000 FEET

750 000 FEET

Johnson

Creek

Rock

CANADIAN

NORTH

RIVER

water

1 Mile

5000 Feet

Scale 1:20000

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
(Joins sheet 5)
R. 5 E.
2 370 000 FEET
760 000 FEET
T. 11 N.
(Joins sheet 11)
(Joins sheet 13)
(Joins sheet 18)
2 355 000 FEET
750 000 FEET
Garden Grove
Painter Creek
NORTH CANADIAN RIVER
Econtuchka
Deer Creek
SEMINOLE COUNTY
water
1 Mile
5000 Feet
Scale 1:20000

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 13

13

N

2 375 000 FEET

760 000 FEET

R. 5 E. | R. 6 E.

T. 11 N.

(Joins sheet 12)

(Joins sheet 6)

(Joins lower left)

(Joins upper right)

(Joins sheet 7)

2 400 000 FEET

R. 6 E.

760 000 FEET

755 000 FEET

2 405 000 FEET

2 395 000 FEET

SEMINOLE COUNTY

OKFUSKEE COUNTY

CANADIAN RIVER

NORTH CANADIAN

Shoal Creek

water

Keokuk Falls

19 20 21 22 23 24 25 26 27 28

1 Mile

5 000 Feet

Scale 1:20000

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Coordinate grid ticks and land division corners, if shown, are approximately positioned

(14)

N

(Joins sheet 8)

R. 2 E.

2 275 000 FEET

2 260 000 FEET

240 000 FEET

230 000 FEET

T. 10 N.

(Joins sheet 15)

(Joins sheet 19)

CLEVELAND COUNTY

1 Mile

5,000 Feet

Scale · 1:20000

SHAWNEE RESERVOIR

SHAWNEE RESERVOIR

South Deer Creek

Deer Creek

South Deer Creek

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 15

15

N

2 280 000 FEET

R. 2 E. | R. 3 E.

(Joins sheet 9)

740 000 FEET

T. 10 N.

(Joins sheet 14)

(Joins sheet 16)

730 000 FEET

2 300 000 FEET

(Joins sheet 20)

Clarks Heights

Whalen

Gilbert

Crossan

North Deer Creek

South Deer Creek

Deer Creek

ATCHISON, TOPEKA AND SANTA FE

CHICAGO, ROCK ISLAND AND PACIFIC

CANADIAN RIVER

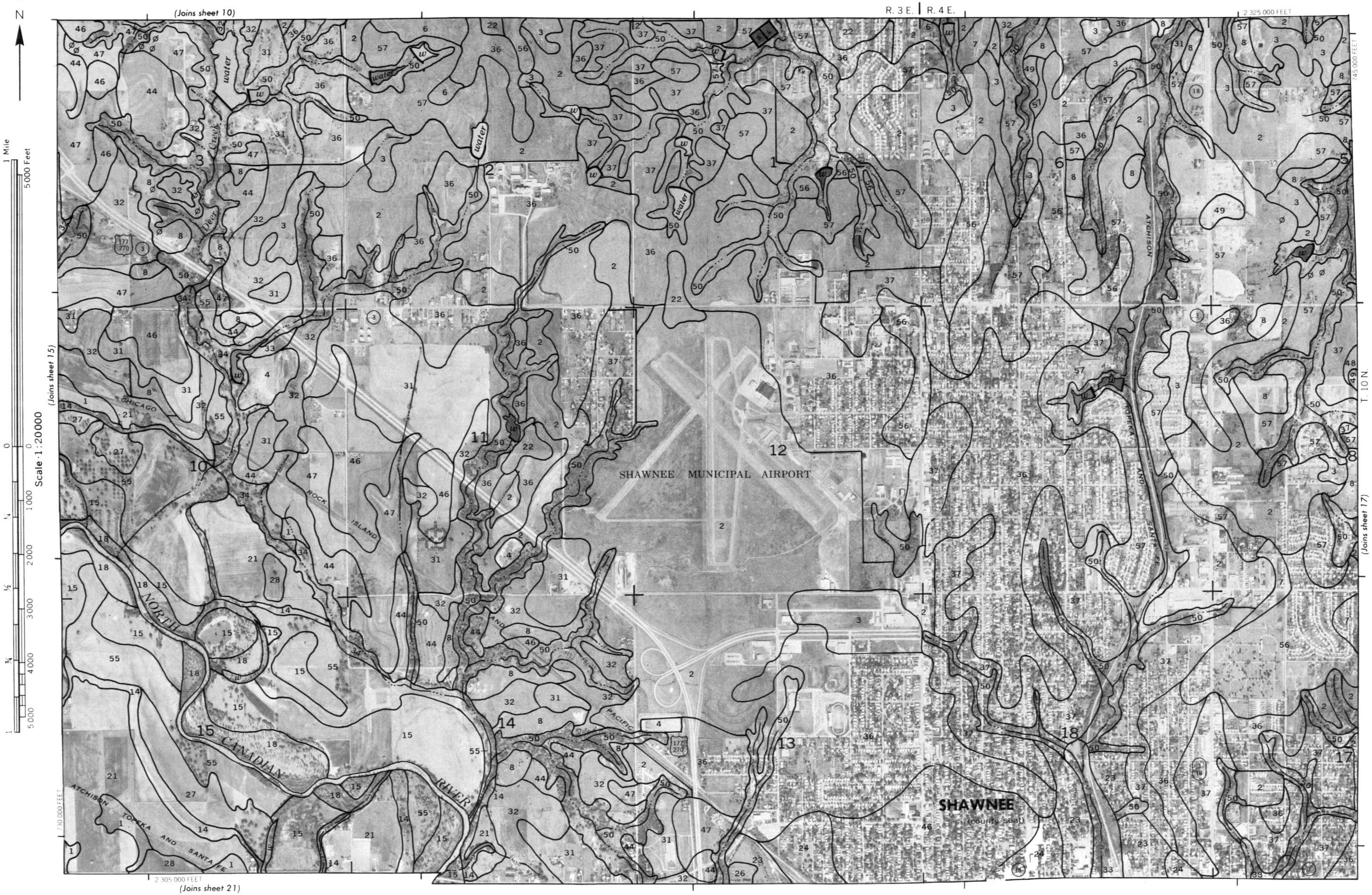
SHAWNEE RESERVOIR

1 Mile

5000 Feet

Scale 1:20000

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned


N
1 Mile
5000 Feet
Scale 1:20 000
(Joins sheet 10)
(Joins sheet 15)
(Joins sheet 17)
(Joins sheet 21)
R. 3 E. | R. 4 E.
T. 10 N.
2 325 000 FEET
745 000 FEET
730 000 FEET
2 305 000 FEET
SHAWNEE MUNICIPAL AIRPORT
SHAWNEE
(county seat)
NORTH CANADIAN RIVER
CHICAGO ROCK ISLAND AND PACIFIC
ATCHISON TOPEKA AND SANTA FE
Deer Creek

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 17

(Joins sheet 11)

R. 4 E.

2 330 000 FEET

745 000 FEET

T. 10 N.

(Joins sheet 16)

(Joins sheet 18)

(Joins sheet 22)

2 350 000 FEET

730 000 FEET

SHAWNEE
(county seat)

NORTH CANADIAN RIVER

Rock Creek

water

N

1 Mile
5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(18)

N

1 Mile
5000 Feet

Scale · 1 : 20000

(Joins sheet 12)

R. 5 E.

2 370 000 FEET

745 000 FEET

T. 10 N.

SEMINOLE COUNTY

(Joins sheet 17)

2 360 000 FEET

2 355 000 FEET

(Joins sheet 23)

N

2 260 000 FEET

R. 2 E.

(Joins sheet 14)

2 275 000 FEET

T. 10 N.

CLEVELAND COUNTY

SHAWNEE RESERVOIR

(Joins sheet 20)

(Joins sheet 24)

1 Mile

5000 Feet

Scale 1:20000

1 inch = 5000 feet

(20)

N

Scale · 1 : 20000

1 Mile 5,000 Feet

(Joins sheet 15) R. 2 E. R. 3 E. 2 300 000 FEET

(Joins sheet 19) T. 10 N. 725,000 FEET

Bethel Acres

Lost Creek

Squirrel Creek

SHAWNEE RESERVOIR

(Joins sheet 21)

2 280 000 FEET 715,000 FEET

(Joins sheet 25)

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 21

21

N

1 Mile
5000 Feet
Scale 1:20000

22

N

R. 4 E.

2 350 000 FEET

(Joins sheet 17)

SHAWNEE
(county seat)

RIVER

CANADIAN

CHICAGO

NORTH

ROCK ISLAND AND PACIFIC

ATCHISON

TOPEKA AND SANTA FE

Rock Creek

Tecumseh Junction

water

CHICAGO ROCK ISLAND AND PACIFIC

(Joins sheet 21)

(Joins sheet 23)

(Joins sheet 27)

725 000 FEET

715 000 FEET

T. 10 N.

20 21 22 23 24 25 26 27 28 29 32 33 34 35 36

1 Mile
5 000 Feet

Scale · 1 : 20000

0 0 ¼ ½ ¾ 1
1000 2000 3000 4000 5000

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 23

23

N

R. 5 E.

(Joins sheet 18)

T. 10 N.

(Joins sheet 22)

(Joins sheet 28)

SEMINOLE COUNTY

2 355 000 FEET

725 000 FEET

2 370 000 FEET

715 000 FEET

Neat

Turkey Creek

water

1 Mile

5000 Feet

Scale 1:20000

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

24

N

(Joins sheet 19)

R. 2 E.

2 275 000 FEET

2 260 000 FEET

700 000 FEET

710 000 FEET

T. 9 N.

(Joins sheet 25)

(Joins sheet 29)

1 Mile

5000 Feet

0

Scale 1:20000

CLEVELAND COUNTY

Pink

Quarter

Creek

Railroad

Creek

Creek

2 280 000 FEET

R. 2 E. | R. 3 E.

(Joins sheet 20)

710 000 FEET

T. 9 N.

Squirrel Creek

Dance Creek

(Joins sheet 24)

(Joins sheet 26)

2 300 000 FEET

(Joins sheet 30)

N

1 Mile

5 000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

700 000 FEET

26

N

(Joins sheet 21)

R. 3 E. | R. 4 E.

2 325 000 FEET

Tecumseh Lake

Hackery

TECUMSEH

T. 9 N.

710 000 FEET

(Joins sheet 27)

(Joins sheet 25)

700 000 FEET

2 305 000 FEET

(Joins sheet 31)

1 Mile 5,000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 27

27

N

R. 4 E.

2 330 000 FEET

(Joins sheet 22)

710 000 FEET

T. 9 N.

(Joins sheet 26)

(Joins sheet 28)

(Joins sheet 32)

2 350 000 FEET

700 000 FEET

ATCHISON, TOPEKA AND SANTA FE

Brier Creek

Scale 1:20000

1 Mile

5000 Feet

This map is compiled on 1942 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately plotted

28

N

1 Mile
5000 Feet
0 0
Scale · 1 : 20000
1/4 1000
1/2 2000
3/4 4000
1 5000

(Joins sheet 23)

R. 5 E.

2 370 000 FEET

710 000 FEET

T. 9 N.

SEMINOLE COUNTY

Earlsboro

CHICAGO

ROCK ISLAND

PACIFIC

Wewoka Creek

Brier Cr.

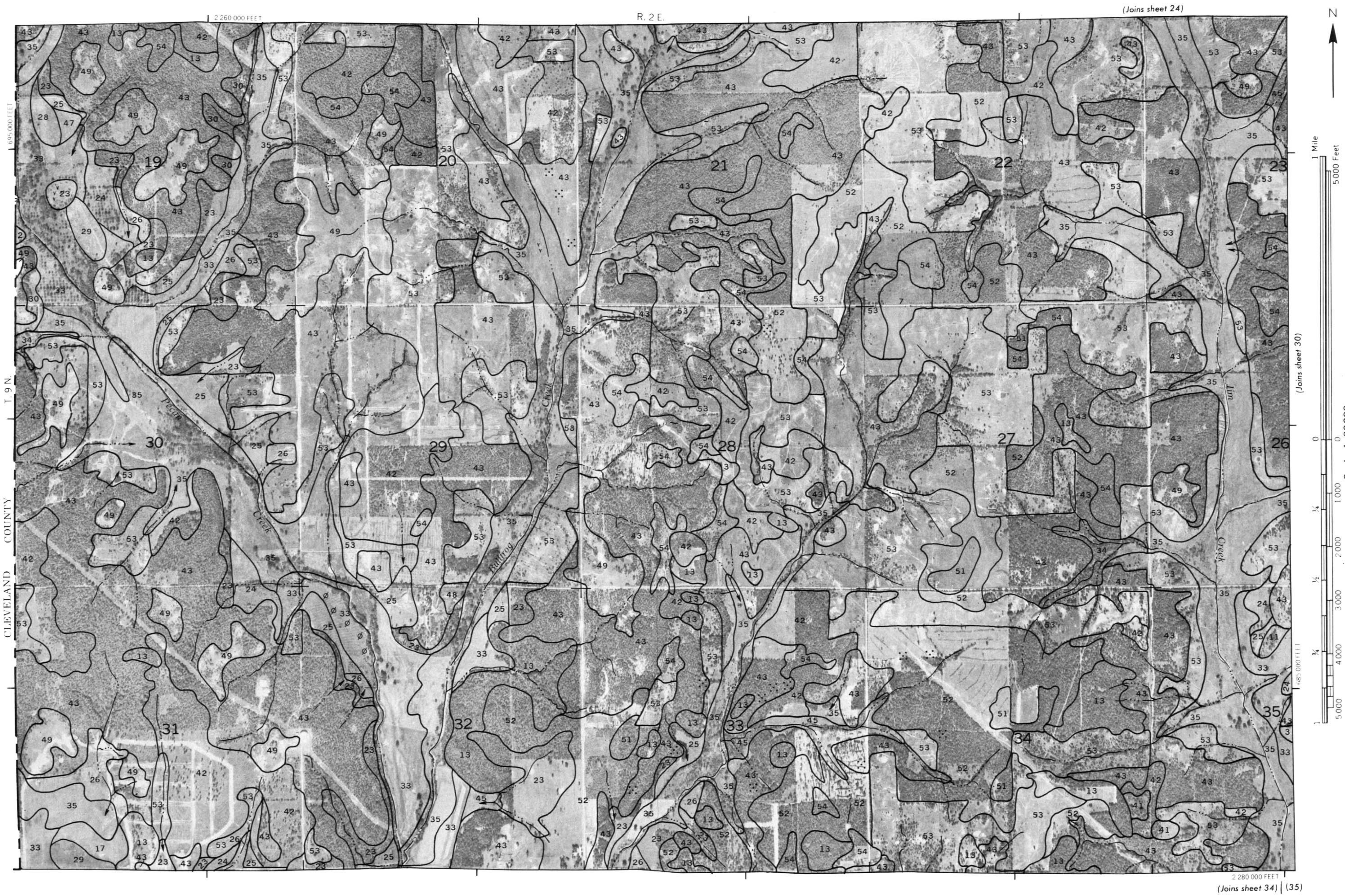
water

(Joins sheet 27)

100 000 FEET

(Joins sheet 33)

2 355 000 FEET


2 260 000 FEET
R. 2 E.
(Joins sheet 24)
N
695 000 FEET
T. 9 N.
CLEVELAND COUNTY
(Joins sheet 30)
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
Scale 1:20000
685 000 FEET
2 280 000 FEET
(Joins sheet 34)
(35)
Pecan
Creek
Bullfrog
Creek
Jim
Creek
19
20
21
22
23
30
29
28
27
26
31
32
33
34
35

(30)

N

1 Mile
5,000 Feet
0 0
Scale · 1:20000
1 ¼ 1000
½ 2000
¾ 4000
1 5000

(Joins sheet 25)

R. 2 E. | R. 3 E.

2 300 000 FEET

695 000 FEET

T. 9 N.

(Joins sheet 29)

(Joins sheet 31)

680 000 FEET

2 285 000 FEET

Dance Creek

Marvin

(Joins sheet 35) | (36)

POTTAWATOMIE COUNTY OKLAHOMA — SHEET NUMBER 31

31

N

R. 3 E. | R. 4 E.

(Joins sheet 26)

2 305 000 FEET

695 000 FEET

T. 9 N.

(Joins sheet 30)

(Joins sheet 32)

2 325 000 FEET

(Joins sheet 36) | (37)

685 000 FEET

1 Mile

5000 Feet

Scale 1:20000


32
N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 27)
R. 4 E.
2 350 000 FEET
695 000 FEET
(Joins sheet 31)
T. 9 N.
(Joins sheet 33)
685 000 FEET
2 330 000 FEET
(Joins sheet 37)
(38)
Hotulke
Harjo
Amerada
LITTLE RIVER
Brier Creek
Little Creek
ATCHISON TOPEKA AND SANTA FE
water
9A

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown are approximately positioned

33

N

2 355 000 FEET

R. 5 E.

(Joins sheet 28)

695 000 FEET

T. 9 N.

Brier Creek

LITTLE RIVER

intermittent

Rogers Creek

SEMINOLE COUNTY

Harjo

Amerada

TOPEKA AND SANTA FE

(Joins sheet 32)

(Joins sheet 38)

685 000 FEET

2 375 000 FEET

1 Mile

5000 Feet

Scale 1:20000

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 34

(34)

N

(Joins sheet 29)

R. 2 E.

2 275 000 FEET

680 000 FEET

T. 8 N.

(Joins sheet 35)

670 000 FEET

2 260 000 FEET

(Joins sheet 39)

Pecan Creek

LITTLE RIVER

Spring Creek

Jim Creek

Council Creek

1 Mile

5,000 Feet

Scale · 1:20000

CLEVELAND COUNTY

(29) (Joins sheet 30)

R. 2 E. R. 3 E.

2 280 000 FEET

680 000 FEET

Jim Creek

Morvin

T. 8 N.

(Joins sheet 34)

(Joins sheet 36)

LITTLE RIVER

LITTLE RIVER

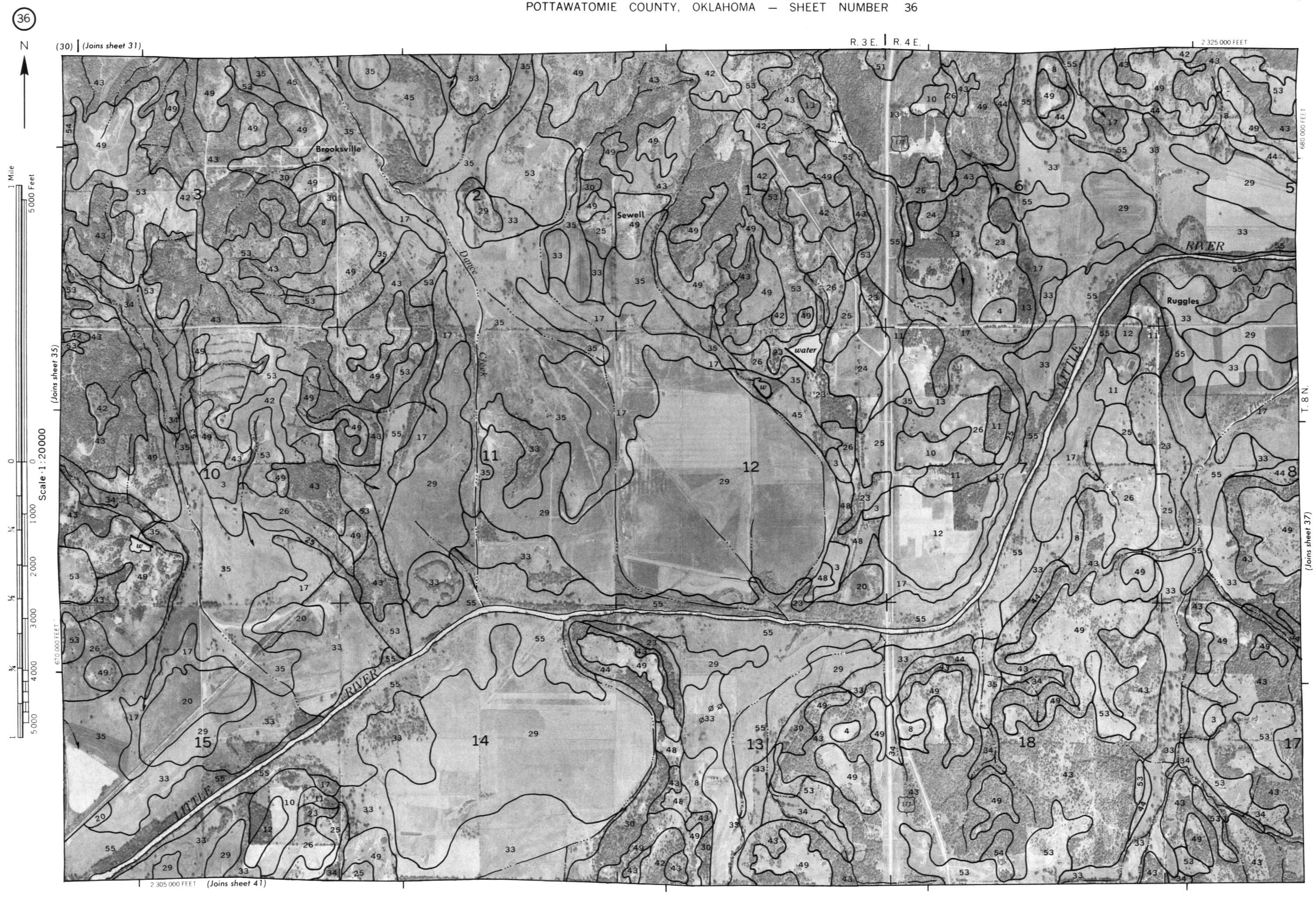
(Joins sheet 40)

2 300 000 FEET

N

1 Mile 5000 Feet

Scale 1:20000



This map is compiled on 1974 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 37

(31) | (Joins sheet 32)

2 330 000 FEET

55 R. 4 E.

N

1 Mile

5 000 Feet

Scale 1:20000

(Joins sheet 38)

(Joins sheet 36)

(Joins sheet 42)

2 350 000 FEET

T. 8 N.

LITTLE RIVER

water


(32) (Joins sheet 33)
R. 5 E.
2 370 000 FEET
680 000 FEET
(Joins sheet 37)
(Joins sheet 43)
2 355 000 FEET
650 000 FEET
N
1 Mile
5000 Feet
Scale 1:20000
Cook
Arthur
LITTLE RIVER
ATCHISON TOPEKA AND SANTA FE
SEMINOLE COUNTY
intermittent
water

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 39

39

N

2 260 000 FEET

R. 2 E.

(Joins sheet 34)

655 000 FEET

T. 8 N.

COUNTY

CLEVELAND

Council Creek

Burnett

(Joins sheet 40)

650 000 FEET

(Joins sheet 44)

2 280 000 FEET

1 Mile

5000 Feet

Scale 1:20000

This map is compiled on 1944 aerial photography by the U. S. Department of Agriculture Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners shown are approximate positions.

(40)

N

Scale · 1 : 20000

1 Mile 5000 Feet

0 0

¼ 1000

½ 2000

¾ 3000

1 4000

5000

(Joins sheet 35)

R. 2 E. | R. 3 E.

2 300 000 FEET

985 000 FEET

LITTLE RIVER

Coon Creek

Sand Creek

Macomb

T. 8 N.

(Joins sheet 39)

(Joins sheet 41)

650 000 FEET

2 285 000 FEET

(Joins sheet 45)

2 320 000 FEET

665 000 FEET

R. 3 E. | R. 4 E.

(Joins sheet 36)

T. 8 N.

(Joins sheet 40)

(Joins sheet 42)

(Joins sheet 46)

2 325 000 FEET

Wye

Romulus

Bois d'Arc Creek

water

N

1 Mile

5000 Feet

Scale 1:20000

42

N

(Joins sheet 37)

R. 4 E.

2 350 000 FEET

665 000 FEET

T. 8 N.

(Joins sheet 41)

(Joins sheet 43)

2 330 000 FEET

(Joins sheet 47)

Remus

water

Creek

Stump Creek

Marcum Creek

1 Mile

5000 Feet

Scale 1:20000

0 1/4 1/2 3/4 1

0 1000 2000 3000 4000 5000

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 43

2 355 000 FEET

R. 5 E.

(Joins sheet 38)

N

1 Mile

5000 Feet

Scale 1:20000

T. 8 N.

(Joins sheet 42)

SEMINOLE COUNTY

Maud

water

(Joins sheet 48)

2 370 000 FEET

(44)

N

1 Mile 5000 Feet

Scale 1:20000

CLEVELAND COUNTY

(Joins sheet 39)

R. 2 E.

2 280 000 FEET

650 000 FEET

T. 7 N.

(Joins sheet 45)

(Joins sheet 49)

2 260 000 FEET

650 000 FEET

Council Creek

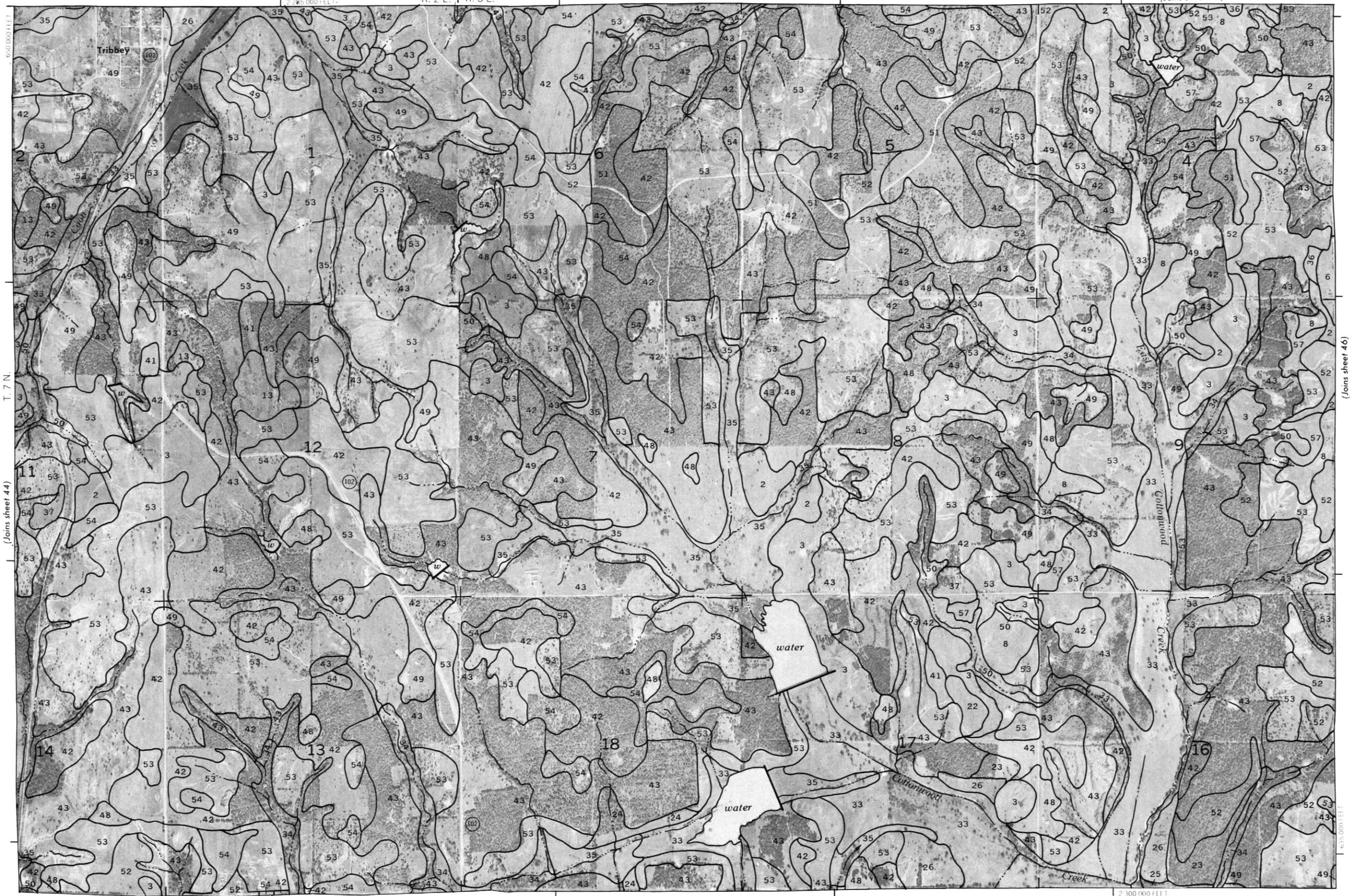
Salt Creek

water

water

water

water



45

N

1 Mile
5000 Feet

Scale 1:20000

(46)

N

(Joins sheet 41)

R. 3 E. | R. 4 E.

2 325 000 FEET

650 000 FEET

T. 7 N.

(Joins sheet 47)

(Joins sheet 45)

850 000 FEET

2 305 000 FEET

(Joins sheet 51)

1 Mile

5000 Feet

Scale 1 : 20000

water

Opossum Creek

Delaware Creek

Salt Creek

Romulus

Anderson

Pearson

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 47

47

N

2 350 000 FEET

650 000 FEET

R. 4 E.

(Joins sheet 42)

T. 7 N.

(Joins sheet 46)

(Joins sheet 48)

(Joins sheet 52)

St. Louis

Box Creek

Sand Creek

Salt Creek

Mission Creek

Blacksmith Creek

intermittent

1 Mile

5000 Feet

Scale 1:20000

48

N

1 Mile

5000 Feet

Scale · 1 : 20000

(Joins sheet 43)

R. 5 E.

2 370 000 FEET

650 000 FEET

(Joins sheet 47)

Ellaville

Salt Creek

Creek

Popshego

Creek

Prairie

intermittent

int

SEMINOLE COUNTY

635 000 FEET

2 355 000 FEET

(Joins sheet 53)

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 49

N

R. 2 E.

2 260 000 FEET

(Joins sheet 44)

630 000 FEET

T. 7 N.

CLEVELAND COUNTY

(Joins sheet 50)

620 000 FEET

(Joins sheet 54)

2 280 000 FEET

East Pond Creek

Salt Creek

Aurora Creek

water

1 Mile

5000 Feet

Scale 1:20000

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

50

N

1 Mile
5,000 Feet

Scale 1:20000

(Joins sheet 45)

R. 2 E. | R. 3 E.

2 300 000 FEET

T. 7 N.

6 30 000 FEET

(Joins sheet 49)

(Joins sheet 51)

620 000 FEET

2 285 000 FEET

(Joins sheet 55)

water

Salt Creek

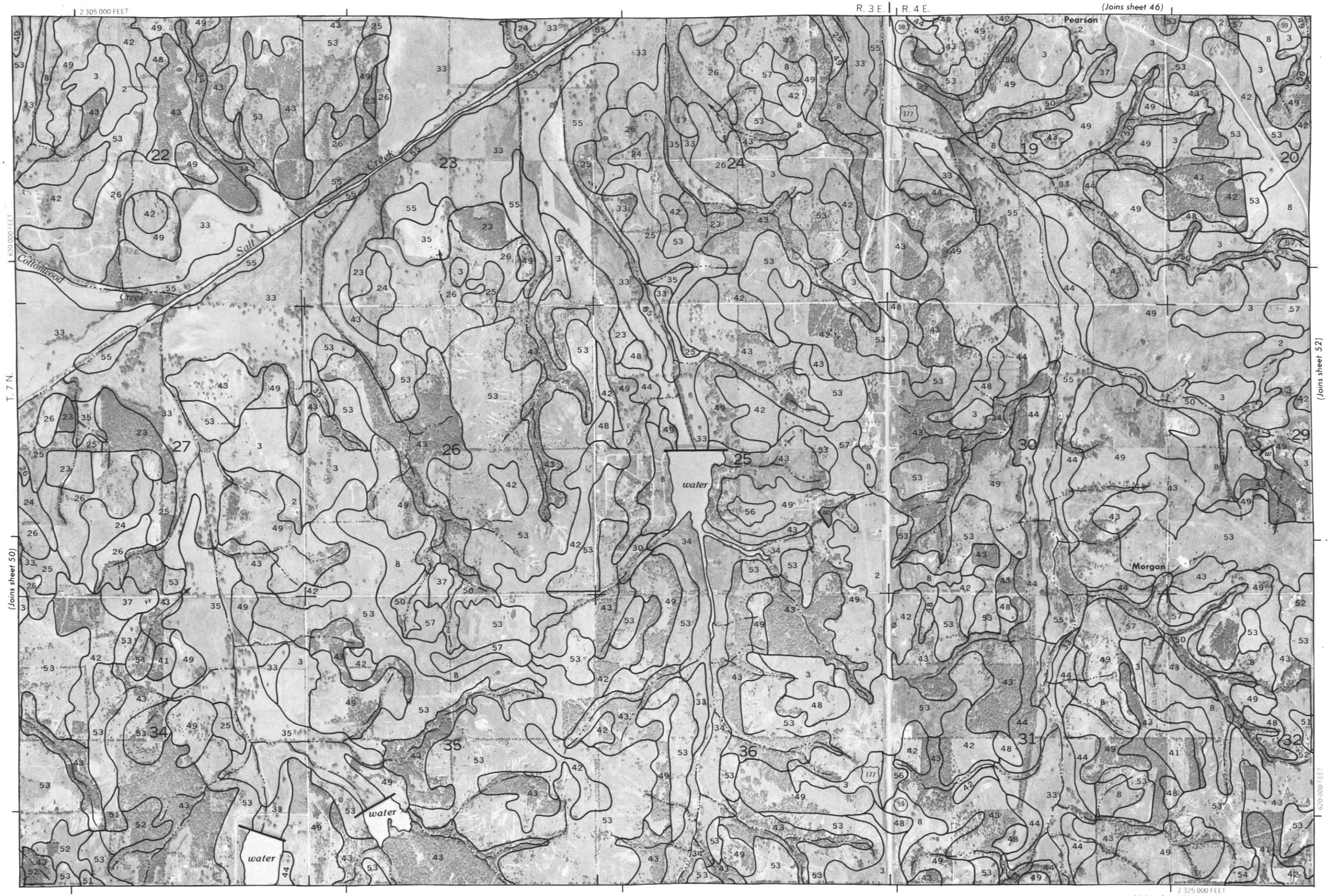
Cottonwood Creek

Wolf Creek

Trousdale

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 51

51



This map is compiled on 197[illegible] aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 53

53

N

2 355 000 FEET

R. 5 E.

(Joins sheet 48)

6 360 000 FEET

T. 7 N.

(Joins sheet 52)

Popshego Creek

Bruno Creek

SEMINOLE COUNTY

19 20 21 30 29 28 31 32 33

water

int

(Joins sheet 58)

2 370 000 FEET

6 370 000 FEET

1 Mile

5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

This map is compiled on 1974 aerial photography by the U.S. Department of Agriculture Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners shown are approximately positioned.

54

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 54

N

1 Mile

5000 Feet

Scale 1:20000

(Joins sheet 49)

R. 2 E.

2 280 000 FEET

615 000 FEET

T. 6 N.

Eason

Creek

Jumper Creek

Pond Creek

Hind Creek

CLEVELAND COUNTY

605 000 FEET

2 260 000 FEET

(Joins sheet 59)

(Joins sheet 55)

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 55

55

N

R. 2 E. | R. 3 E.

(Joins sheet 50)

2,285,000 FEET

T. 6 N.

605,000 FEET

water

Creek

Wolf

Hog

Creek

(Joins sheet 54)

(Joins sheet 56)

2,300,000 FEET

(Joins sheet 60)

1 Mile

5000 Feet

Scale 1:20000

This map is compiled on 1941 aerial photographs by the U. S. Department of Agriculture Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

56

N

(Joins sheet 51)

R. 3 E. | R. 4 E.

2 325 000 FEET

605 000 FEET

T. 6 N

(Joins sheet 55)

(Joins sheet 57)

605 000 FEET

2 305 000 FEET

(Joins sheet 61)

1 Mile

5000 Feet

Scale · 1 : 20000

water

Avoca

Asher

Cal Creek

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 57

57

N

R. 4 E.

2 330 000 FEET

(Joins sheet 52)

T. 6 N.

615 000 FEET

(Joins sheet 56)

(Joins sheet 58)

605 000 FEET

(Joins sheet 62)

2 350 000 FEET

Bluehill Creek

Bruno Creek

water

1 Mile

5 000 Feet

Scale 1:20000

58

N

1 Mile
5000 Feet
Scale 1:20000

(Joins sheet 53)

R. 5 E.

2 370 000 FEET

615 000 FEET

T 6 N

SEMINOLE COUNTY

water

Creek

Bruno

Sacred Heart

Muddy

(Joins sheet 57)

605 000 FEET

(Joins sheet 63)

2 355 000 FEET

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 59

59

N

2 260 000 FEET

53

R. 2 E.

57

(Joins sheet 54)

600 000 FEET

T. 6 N.

CLEVELAND COUNTY

19

20

21

22

23

30

29

28

27

26

31

32

33

34

35

Pond

Creek

water

Pond

Creek

590 000 FEET

(Joins sheet 60)

(Joins sheet 64)

2 280 000 FEET

1 Mile

5000 Feet

Scale 1:20000

0 0

¼ 1000

½ 2000

¾ 3000

1 4000

5000

This map is compiled on 1974 aerial photographs by the U. S. Department of Agriculture Soil Conservation Service and cooperating agencies.
Roads are approximately positioned.
Coordinate grid ticks and land division corners, if shown, are approximate.

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 60

60

N

1 Mile

5,000 Feet

Scale 1:20000

(Joins sheet 55)

R. 2 E.

R. 3 E.

2,300,000 FEET

600,000 FEET

T. 6 N.

(Joins sheet 59)

640,000 FEET

(Joins sheet 61)

(Joins sheet 65)

2,285,000 FEET

Wanette

Hog Creek

Julian Creek

Pond Creek

2 305 000 FEET

R. 3 E. | R. 4 E.

(Joins sheet 56)

N

600 000 FEET

T. 6 N.

Asher

Cut Creek

Chism Creek

Lillian Creek

CANADIAN RIVER

McCLAIN COUNTY

POTTAWATOMIE COUNTY

22 23 24 19 20 27 26 25 30 29 34 35

(Joins sheet 60)

(Joins sheet 62)

(Joins inset, sheet 66)

540 000 FEET

2 325 000 FEET

1 Mile
5 000 Feet
Scale 1 : 20000

62

N

1 Mile

5000 Feet

Scale 1:20000

(Joins sheet 57)

42

R. 4 E.

2 350 000 FEET

600 000 FEET

T. 6 N.

(Joins sheet 63)

(Joins sheet 61)

540 000 FEET

2 330 000 FEET

(Joins sheet 66)

Chism Creek

Trauma Creek

Pecan Creek

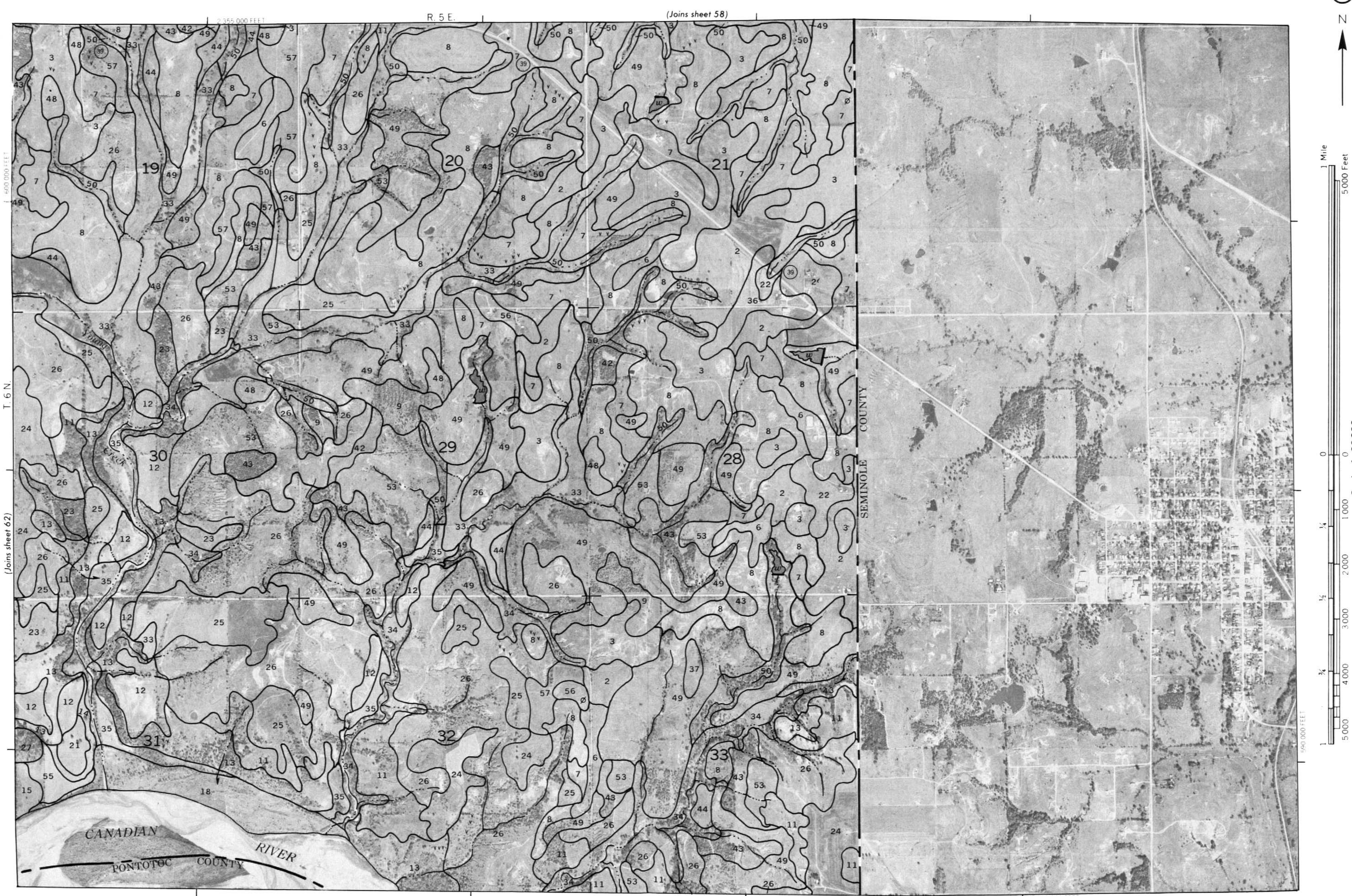
Mud Flat Creek

water

CANADIAN RIVER

POTTOTOC COUNTY

20 21 22 23 24 25 26 27 28 29 32 33 34 35 36



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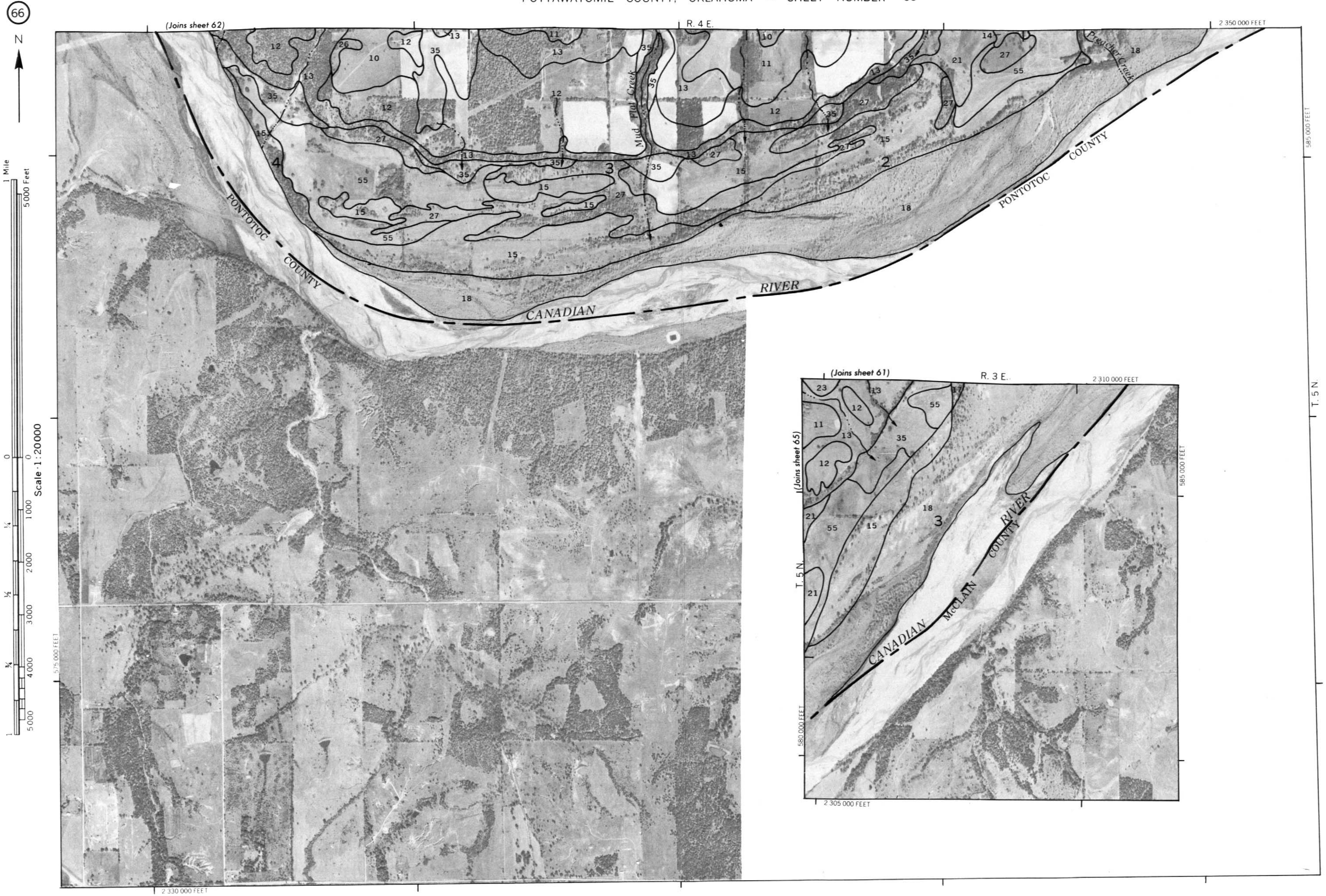
This map is compiled on 19[illegible] aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 19[illegible] aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

POTTAWATOMIE COUNTY, OKLAHOMA — SHEET NUMBER 67

67

2 355 000 FEET

R. 5 E.

(Joins sheet 63)

585 000 FEET

T. 5 N.

CANADIAN RIVER

PONTOTOC COUNTY

SEMINOLE COUNTY

575 000 FEET

2 375 000 FEET

N

1 Mile

5 000 Feet

Scale 1:20000

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.